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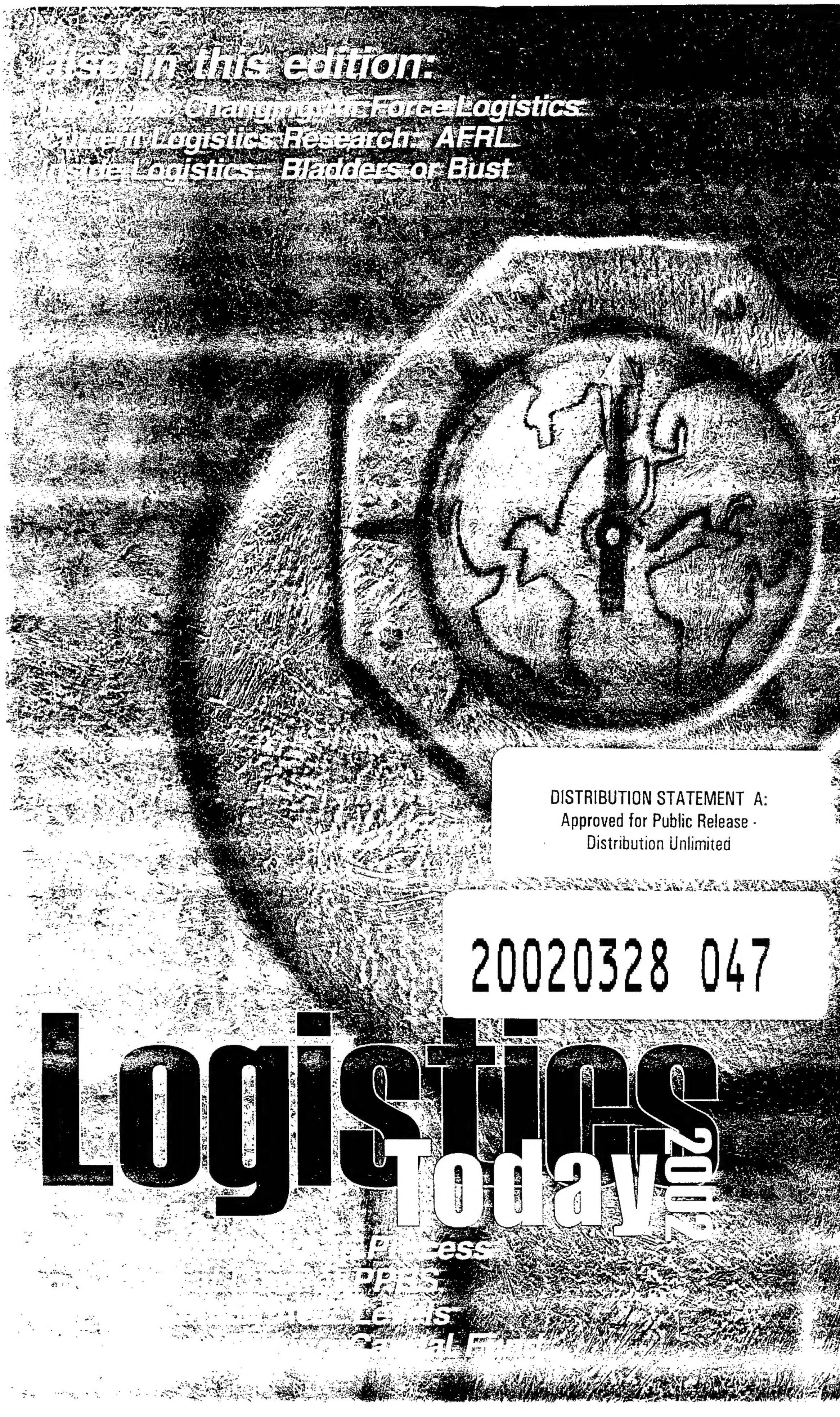

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Process
PPBS
Levels
Capital Fund

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Volume XXV, Number 3

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Errata, Volume XXV, Number 3

On page 25, the author of "Murphy's Law" should be Colonel Logan "Jay" Bennett, USAF, Retired.

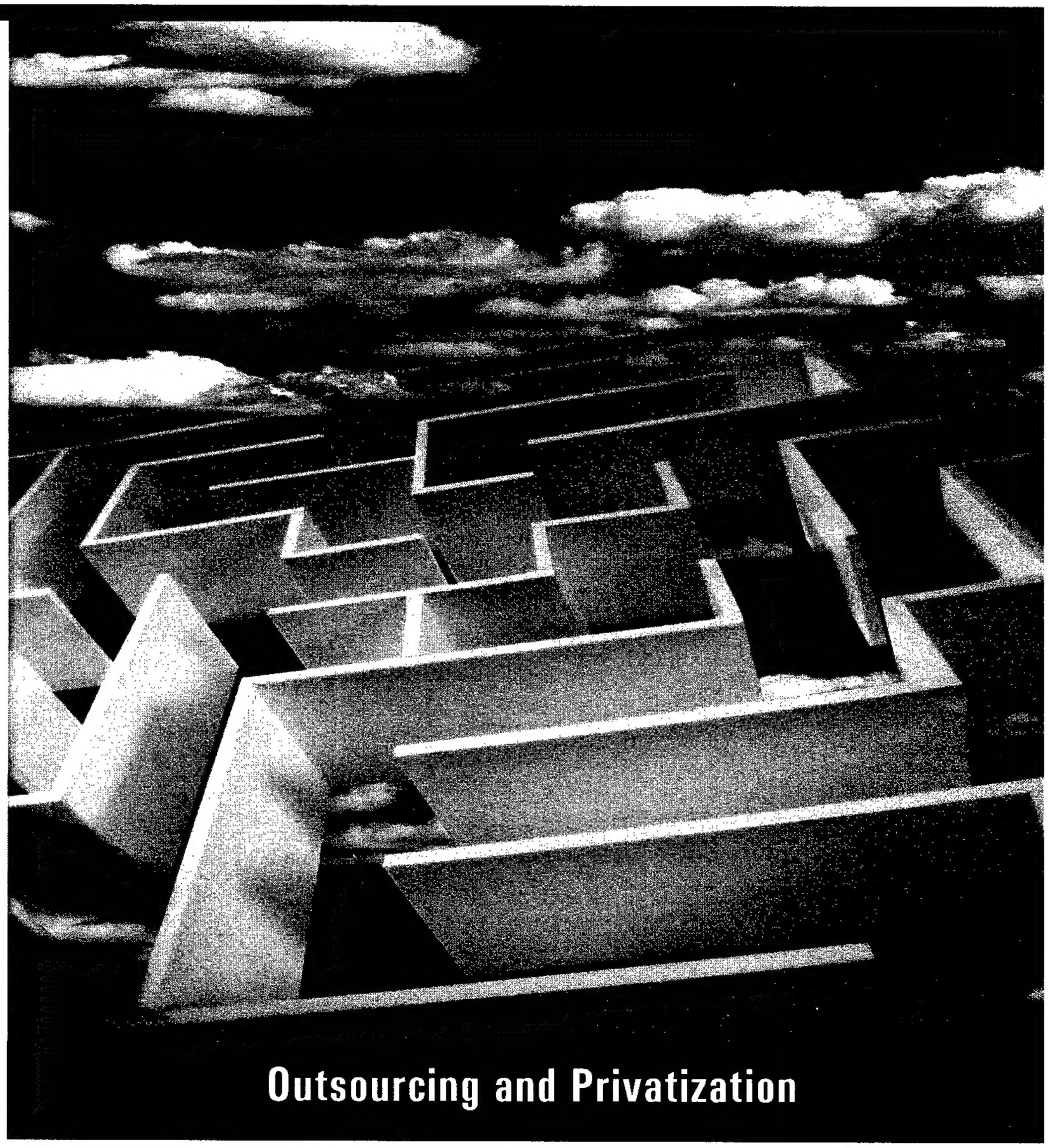
On page 27, Captain Steven Smitherman's title should be Equipment Maintenance Squadron maintenance supervisor.

Logistics Today

Pressures of a Shrinking Budget

Pitfalls of the A-76 Process

Captain Justin W. Lavadour, USAF
William A. Cunningham III, PhD



Outsourcing proponents have always pointed out its benefits—lower costs and the ability to move military manpower to other, more vital, career fields. Supporting evidence for these claims has come mostly from successes in the US private sector or from other countries. What has been ignored in this argument is the outsourcing process for the military is fundamentally different from that used in either of the previously mentioned circumstances. Before continuing this debate, it is first necessary to briefly explain the A-76 or outsourcing process.

Functions to be outsourced are first nominated from a unit, a group, a base, a command, or the top of the Air Force chain of command. A request for approval to review the function for competition is then sent up the chain of command. Once approval is granted, Congress and the base are notified the nominated function will be evaluated. The base then appoints a team to develop a performance work statement (PWS), explaining what type of work is required, approximate man-hours, skills, and so on. After the PWS is developed, it is sent out to the private sector for bidding. Another team is organized to develop the government's bid, which is known as the most efficient organization (MEO). Once the MEO has been approved and bids from the private sector have been collected, they are evaluated via a computer program called COMPARE. If any of the contractors can beat the MEO's bid by 10 percent or $2M, whichever is less, the contractor will be awarded the contract.

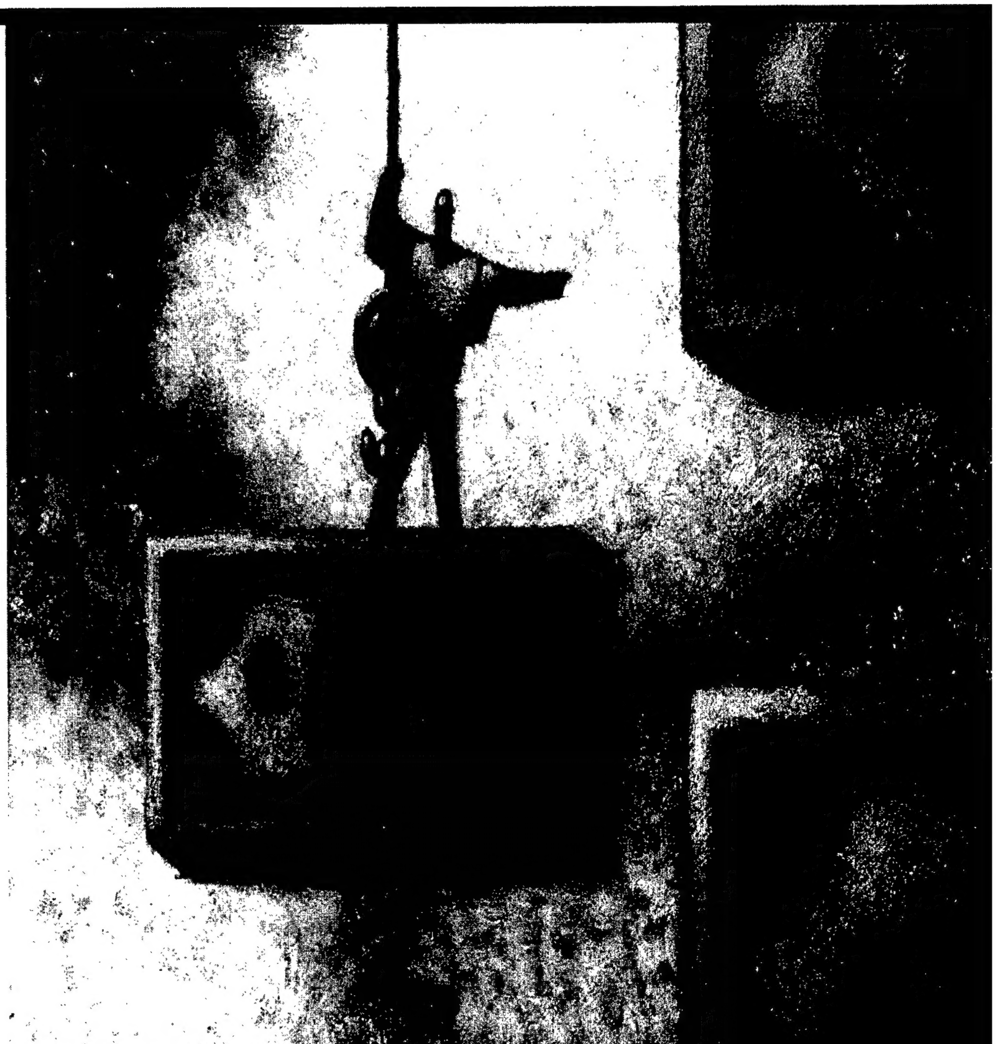
Because they ignore the nature of military's outsourcing process, most of the conclusions drawn about the benefits of A-76 have been more theoretical in nature and difficult to substantiate. A recent Government Accounting Office (GAO) report on outsourcing over the last 5 years found the claimed savings were difficult to verify.[1] If outsourcing is going to produce the expected results, it is necessary to review the process and ensure it is functioning in a manner that produces success.

The process must incorporate factors critical to the success of the process. By examining past examples of outsourcing, it is possible to determine

(Continued on page 38)

A Critical Look at PPBS

The Air Force resource allocation process operates within the framework of the Planning, Programming, and Budgeting System.



Major Clarence Johnson, USAF

Prelude to Crisis

The Chinese use two brush strokes to write the word crisis. One brush stroke stands for danger, the other for opportunity. In a crisis, be aware of the danger—but recognize the opportunity.

— **Richard M. Nixon**

PPBS

The Air Force resource allocation process, to include the unfunded priority list (UPL), operates within the framework of the Planning, Programming, and Budgeting System (PPBS). To appreciate the UPL process, one must first understand how the UPL fits into the overall PPBS.

The PPBS produces:

> . . . a plan, a program, and a 2-year budget for the Department of Defense (DoD) with the ultimate objective of furnishing the combatant commanders with the best mix of forces, equipment, and support attainable to meet the current and future threat within fiscal constraints.[5]

The PPBS sprang from Secretary Robert S. McNamara's Defense Department in 1961 and remains surprisingly effective and resilient for its age.

> Prior to the PPBS, there was no integrated central process within DoD for systematically consolidating, reviewing, and analyzing service programs. Formal review at the level of the Office of the Secretary of Defense (OSD) usually took place during annual budget reviews. The exercise of management through the appropriation structure required by Congress made it difficult to relate budgets to military missions. To overcome this deficiency, Secretary McNamara established the PPBS.[6]

An integral part of the national planning system, the PPBS consists of three discrete phases that work together to acquire and allocate defense resources: planning, programming and budgeting.

Given the reduced defense spending the department has witnessed over the last 8 years, the President's Budget (PB) Request has been consistently insufficient to address all Air Force funding requirements.[7] Each programming cycle, the shortfall is first

The Unfunded Priority List

realized as the major commands (MAJCOM) work to develop their program objective memorandum (POM) inputs. Each MAJCOM is provided a starting budget allocation-planning figure (bogey), which lately has fallen well below the individual MAJCOM requirements.[8] Those requirements that fall below the available MAJCOM funding allotments are forwarded to the Air Staff with the MAJCOM POM inputs as unfunded requirements. The most significant unfunded requirements are documented in the integrated POM at Force Tab P. At the end of the budgeting process, Tab P is reviewed, and its entries are typically grouped into the following four categories: people, infrastructure, readiness, and modernization. Each of the corresponding lists is then prioritized.[9] The Air Force corporate process then reviews the individual unfunded lists and uses them to develop a single, integrated top-20 list. This integrated top-20 list—along with the four prioritized, segregated lists accompanying it—is then forwarded to the Chief of Staff of the Air Force for review and approval. Once approved, the Chief forwards the unfunded requirements to Congress. This product has come to be known as the Chief's UPL.[10]

Not Enough Food for the Nest

Most people would succeed in small things if they were not troubled with great ambitions.

— Henry Wadsworth Longfellow

There is a euphemism among those who work within the Air Staff resource allocation process that the, "Air Force has never met a requirement it didn't like."[11] Responses to this expression are mixed. Some laugh at it, while others find no humor in it whatsoever. The fact remains that the Air Force's requirements continue to outpace its funding year after year. In such a fiscally constrained budget environment, it is inevitable that tough decisions have to be made, and resources for certain funded activities must be reduced or reapportioned to pay for critical emerging requirements. At issue, however, is the reduction and reapportionment of resources belonging to funded programs to pay for new UPL initiatives that have not been properly programmed and budgeted.

Czelusniak and Rodgers define program instability as:

> . . . the reallocation of funding to other near-term priorities external to a program. These kinds of repeated funding excisions ultimately lead to sizable program cost growth. This growth contributes no added value whatsoever to the system being developed or produced.[12]

This article focuses on the instability funded modernization programs experience as a result of unfunded requirements associated with UPL projects.

According to the Air Force *PPBS Training Program Reference Book* released in 2000, the UPL is defined as follows:

> The UPL is a corporately approved list of unfunded programs within a focus area chosen annually by the Chief of Staff. These programs are designated to receive funding should additional money become available. Prior areas of focus

Prelude to Crisis: 1500 Hours

As the four-ship of F-15E Strike Eagles prepared to leave from Kuwait to do its duty for Operation Southern Watch, Major Jeff Gatson could scarcely believe he was back flying again. Just 4 months ago, he was an action officer (AO) for Strike Eagle requirements and funding at Air Combat Command's (ACC) Langley AFB, Virginia. Like most operators, Jeff loathed staff work. As an AO, he was responsible for developing requirements for his aircraft and ensuring budget inputs reflected the warfighter's needs. For his entire tour at Langley, Jeff felt the extreme weight of the job pressing heavily upon him. He knew his buddies out in the field flying were counting on him not to get caught up in all the BS and red tape common to headquarters, rather, to make sure the Strike Eagle's true requirements were well-represented. Jeff did his best. He won a few but lost a great many more. It was the nature of the budgeting and requirements game. All in all, he was glad to be looking at all that bean counting and politics through his rearview mirror. An Air Force Weapons School graduate and instructor, Jeff had excelled in the cockpit and was destined to be a squadron commander. For now, he was just happy to be back flying. Today's mission was fairly routine. His four-ship was to patrol the skies of southern Iraq to ensure Sadaam Hussein complied with the United Nation's no-fly restriction. All the Strike Eagle crews scheduled to fly knew their air package would take them into hostile territory, but they didn't expect to see any action today. The climate in Southwest Asia (SWA) had grown extremely tense over the last few months. Islamic extremists, believed to be affiliated with known terrorist Osama Bin Laden, had been very active on the Arabian Peninsula. It was clear—while US aid, deterrence, and commerce were welcomed by the Gulf States—there were many who despised the American presence on the peninsula. After the bombing of the *USS Cole*, the State Department had been closely watching developments in the Middle East, cautioning American servicemen and citizens abroad to remain extremely alert. The recent incident involving the American Marine who smuggled the Bahraini princess out of the country also served to feed the extremist belief the American

presence on the peninsula only brought decadence and immoral influences to the Islamic communities in the region. As a result of the heightened tension, there had been an increasing number of threats against US installations and government facilities in SWA over the last few weeks, but Jeff thought to himself, "So what's new?" For the next 120 days, Jeff would be one of the many US pilots doing his part in support of Operation Southern Watch. Some experts on Middle Eastern affairs and intelligence analysts back home had warned both the Clinton and incoming Bush administrations, as well as the Defense Department, that the increased terrorist activities targeting the government had served to bolster Sadaam's rhetoric against the United States. Experts believed this, combined with the frustration he was feeling from the multilateral economic sanctions, might embolden the Iraqi leader to either sponsor extremist groups known to use asymmetric weapons and tactics or possibly act out aggressively in a unilateral fashion against the United States.

Major Gaston, "Vapor" as he was called by other flyers, was crewed with a weapon system officer (WSO) named Richey Slade. Slade, like Jeff, had recently returned to flying after a staff tour at the Pentagon's Weapons Requirements shop. The two were old friends, having flown together at Seymour Johnson AFB, South Carolina, and attended the Weapons School together as captains. In fact, Jeff knew nearly everyone in the four-ship from previous tours of duty. At the point was Major Tom "Malibu" Browne with his WSO, Major Nate Jackson. In the other two Strike Eagles were Major Ron "Toolman" Tinkham and his WSO, Major Bert Morales, and Major Mark "Griz" Grisham and his WSO, Major Jaime Rodriguez. Jeff knew Toolman, Griz, and Jaime from his Air Force Academy days. He knew Nate and Malibu from a tour at Elmendorf AFB, Alaska. All were quick-witted and loved to joke, especially Tinkham and Browne. Jeff thought to himself as they prepared to taxi, "If I've got to be out here playing in this sandbox away from my family, at least I'm flying, and it's with some good dudes." Among the guys in the squadron, Jeff seemed to catch more than his share of grief. This was due mostly to many of the funding shortfalls and weapon system fielding delays the Strike Eagle experienced on Jeff's watch at Langley. This was a real sore point with Jeff. He just couldn't seem to get the guys to understand that 99 percent of the funding and requirements decision for the F-15 were made way above his pay grade. But Jeff really couldn't blame the guys. He, himself, was still trying to make sense of the Pentagon's PPBS and unfunded requirements process.

Shootdown: 1615 Hours

About an hour into the mission, the radar warning receivers in all four F-15s lit up. Apparently, a portion of Iraq's integrated air defense system (IADS) had been powered up, and someone on the ground was trying to draw a bead on the four-ship. The aircrews identified the immediate threat as surface-to-air missiles (SAM), surface-to-air missile 2s (SA-2), to be exact. The SA-2 was vintage Soviet SAM technology. The Iraqis learned during the Gulf War that, when they turned on their ground-radar systems, the US aircrews could home in on their positions and deliver munitions much easier. Therefore, when they had hostile intents, the Iraqi ground-based radar operators kept their systems turned off until they were ready to fire on coalition aircraft. Malibu was the first to break silence. "What the hell do those guys think they're doing down there?" The aircrews instinctively began to take evasive actions. While these SAMs were aging systems, the guys knew SA-2s could knock them out of the sky just as easily as the more advanced SA-7s and SA-10s. As the F-15s began to climb to a safer altitude and radio the hostile activity to the airborne warning and control system (AWACS) in the area, Jeff heard a loud explosion and felt a jolt that shook the entire aircraft. At first, he thought a SAM had just missed their aircraft, but suddenly, his cockpit displays lit up. "Oh, crap, we're hit! Malibu, this is Vapor, we're hit. I'm having trouble controlling her. I think we sustained major damage to our right wing and the aft portion of the fuselage. Richey, how's it look back there?" There was no answer from Major Slade, Jeff didn't know it at the time but soon discovered Slade had been severely injured by the SAM strike and was unconscious. Jeff was surprised at how little time it had taken him to put on his game face. The airwaves were suddenly abuzz with aircrews trying to get a fix on the threat and provide assistance to Jeff. "Malibu, this is Vapor, I've got a dead stick . . . she's not responding. Oh, God, I think we're going to have to punch out." For all his joking on the ground, Browne (Malibu) was known for his calm demeanor under fire. However, the surprise of the ground-based attack even caught him off guard. Browne was frantic. "Vapor, you're on fire; get out . . . get out now!" The cockpit was awash with red lights and flashing indicators. Jeff knew there was precious little time left to get his crew out of the aircraft, and with Slade unconscious or possibly dead, it would be up to him to get them out. He instinctively tucked his arms and legs close in to avoid injury as the chair exploded up the rails during the ejection sequence. He prayed the ejection wouldn't further injure his back-seater. It was now or never. Jeff reached for the ejection handle down by his thigh. He gave it a strong pull. The next thing he knew, he was looking up at his chute. As near as he could tell, he either passed out momentarily, or things were moving so fast he had been blown free of his cockpit before the event even registered with him. Jeff was disoriented. Later, he would recount feeling dazed and thinking odd thoughts as he hung under canopy. He even remembered thinking, "I wonder if my wife remembered to call the garbage service about missing last week's pickup." Jeff's first coherent thought was for his WSO. He looked around and could see a second chute off his 3 o'clock. From his vantage point, he could see Richey hanging lifeless by his parachute straps. Jeff desperately hoped he was okay. He wouldn't know until they hit the ground. About then, he started thinking about what would be waiting for them on the ground. Who was firing at them? Were these Iraqis at work or terrorists operating out of Iraq? The parachute ride lasted only about a minute and a half, but it seemed like an hour and a half. As he hung there, Jeff really started getting pissed off about some of the budget decisions that had been made concerning the Strike Eagle while he was at ACC. Due to must-pay bills identified by a startup UPL project, the F-15 had lost critical funding for the Strike Eagle's low-band jammer, known to aircrews as Band 1.5. Band 1.5, when fielded, would provide the Strike Eagle with low-band jamming protection against specific SAM threats. The loss of funding reduced the size of the early production lots and delayed the fielding of the system in any

significant quantities by nearly 3-1/2 years. He couldn't help but think if they had been flying Band 1.5 today maybe they wouldn't be in this fix. For the first time, Jeff was realizing the true operational impacts of Air Staff bill-paying exercises. As he braced for the landing impact, he thought, "How on earth does stuff like this happen?"

have included modernization, readiness, people, and quality of life. Programs included on the list are those that are completely unfunded. Programs that are underfunded or otherwise impaired are not candidates for the UPL.[13]

Actual performance data indicate not all UPL entries meet this standard. For example, of the 20 initiatives submitted as modernization projects in the FY00 UPL, 7 requested funding to accelerate existing programs or fix those that were impaired.[14] What is more disturbing than the fact the Air Force is not abiding by its own criteria for UPL project consideration is that the definition identifies ideal candidates for UPL consideration as ones that are completely unfunded (not those that are underfunded or otherwise impaired). If followed explicitly, this criterion would be a recipe for program instability.

Overlapping Budget Cycles

The nature of the PPBS is overlapping budget cycles. That is, before a budget for a specific year is approved by Congress and signed into law by the President, the Services are already well down the road to developing the next year's budget (Figure 1).[15] For example, while the FY01 budget is on the Hill being sorted out by Congress, the Services are building the FY02 budget. Continuing with this example, the FY01 budget was forwarded to Congress in early February 2000. The FY01 UPL was forwarded to Congress 8 February 2000. The final decisions concerning which, if any, FY01 Air Force UPL items would be funded were not made until the FY01 Appropriations Conference was completed in September 2000. At that time, the FY02 Budget Estimate Submission (BES) was being submitted for OSD/Office of Management and Budget (OMB) review. In very real terms, this means that for completely unfunded new start programs the Air Force placed on the FY01 UPL (specifically those for which the Air Force did not initially program FY02 funding), by the time the FY01 Appropriations Conference reported out, it was virtually too late for the Air Force to add continuation funding to these programs as a part of the FY02 budget. Therefore, some programs received FY01 congressional plus-up funding to begin work in FY01 but did not have continuation funding budgeted for their second year. In such a case, there are basically three ways to continue these new efforts in their second year:

1. Source the shortfalls out of other funded modernization programs.
2. Depend on Congress to again provide additional funding in FY02 even though the program no longer meets the UPL definition.
3. Stretch the FY01 plus-up funding for these new starts into FY02 (if possible) to keep the programs alive.

Solutions 1 and 3 are inefficient uses of resources, while solution two adds significant schedule risk to programs and raises questions about the ability to meet full funding contract requirements. In each case, modernization programs are subject to actual or potential instabilities.

Analysis Part I: Defining Moments

One who is confused in purpose cannot respond to his enemy

— Meng

How big is this UPL challenge? As mentioned earlier, this article focuses on Air Force UPL activity from FY99 through FY01. More specifically, it focuses on the modernization inputs for those years. But what are these so-called modernization projects? The *PPBS Reference Guide* defines modernization as follows: "Provides the force structure new systems and upgrades to existing systems."[16] Simply put, modernization projects that show up on the UPL are new systems the Air Force is looking to purchase (developmental or commercial off-the-shelf products) and modification or upgrades to existing fielded systems.

Key Terminology

The reader will encounter terms like *multiyear project*, *new start*, or *multiyear new start*. For the purposes of this article, multiyear projects are those modernization efforts that take more than 1 fiscal year to complete. Therefore, funding requirements for multiyear projects span 2 or more years. New starts are those projects that have not been funded previously and no work has begun on the effort due to the lack of available funding. Tying these two concepts together, a multiyear new start project is one that was not started previously or funded and one that will take more than a year to complete once funding is received and work begins on the effort.

Funding Instability

Having defined a few important terms, it is important to next identify the components of funding instability most salient to this research, which is concerned primarily with the two forms of funding instability referred to as *somatic* and *acute*. Specific UPL projects that contribute to these forms of funding instability are identified later with specific focus on multiyear new start projects that receive congressional plus-up funding to begin work but are not supported with continuation funding by the Air Force. When this occurs,

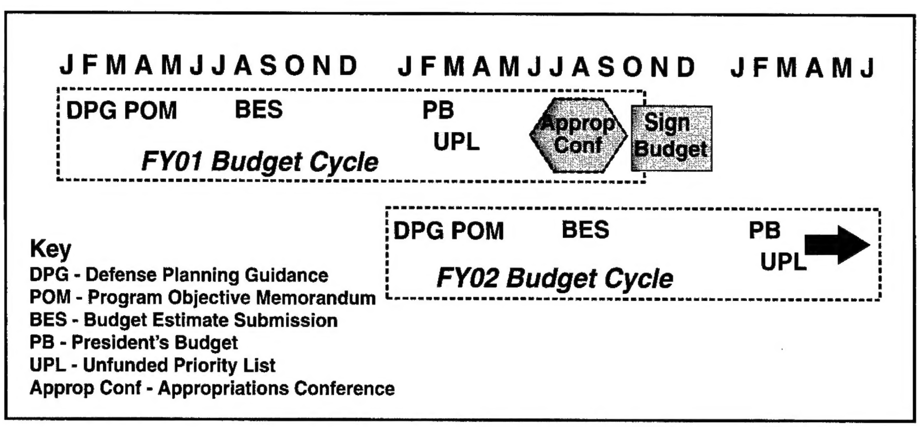


Figure 1. Overlapping Budget Cycle

Nesting Eagles: 1630 Hours

As Jeff hit the desert floor, he was startled back to reality. He was on the ground in Iraq with an injured crewmember. As he instinctively worked to free himself from his parachute harness and secure his ejection seat survival kit, the sound of small arms fire erupted nearby. Clearly in shock, Jeff wasn't sure who was shooting and if they had a fix on his position. His only thought was getting to Slade to see if he was okay. Looking around in the direction of the gunfire, he could hear cheers of victory in Arabic just over the hill from where he was. He had hoped the gunfire was just a victory celebration of the scoring of a kill against the US premier dual-role fighter. Scanning the terrain for cover, he spotted his WSO lying face down on the desert floor, lifeless. Jeff knew he didn't have much time. Whatever their intent, whoever they were, the Arabs just over the hill would soon be mounting a search party to find the downed wreckage and any survivors. Doing his best to conceal his chute amongst some rocks, Jeff ran low and fast over to Slade. He was hurt bad but still breathing. Jeff would have to work fast. He first worked to free Slade from his chute and then to secure it so as not to give away their position. For the first time in his life, he felt his heart beating like a reckoning. Each beat represented a second. With every second that passed while his crew was on the ground, their chances of getting out safely diminished. Jeff tried to get control of his fear. It felt as if his heart would jump out of his chest. He was scared senseless, yet he had the presence of mind to know he needed to get it together. Was this what it felt like to be in ground combat? In a sick sort of way, the situation was kind of funny. Given the bravado he normally exhibited as an F-15 pilot flying one of the world's most lethal weapon systems, he was suddenly in a position of disadvantage and scared out of his mind. "We've got to evade until they can get in to pull us out," he thought. "But where could they hide in the middle of the desert?" In Jeff's line of work, it is better to be lucky than good. As he scanned the horizon, he spotted a rock outcropping about a mile from their location. This was unusual for southern Iraq. Northern Iraq tends to be more rocky and mountainous. Whatever the case, he was very happy to see that grouping of rocks. Then, suddenly, it hit him. Slade was unconscious, and he would have to carry him to safety. Jeff could do nothing but laugh to keep from crying as his elation for finding a place to hide quickly turned into anguish. A small guy himself, Jeff couldn't have picked a worse person to have to carry on his back in the middle of a hot desert. Slade was an ex-college football running back weighing in at about 220 pounds. The one thing Jeff did have going for him was his fitness. Working feverishly, he struggled to lift Slade's dead weight into the fireman's carrying position. His knees nearly buckled under the weight. Only able to carry Slade in about 100-yard intervals before having to stop for a breather, it took Jeff nearly half an hour to cover the distance to the rocks. It took him two more trips to collect the parachutes and their ejection-seat survival kits. Jeff knew the other guys in the formation saw them eject safely before the plane was engulfed in flames. He also knew fuel would soon be an issue for the other F-15s, which meant they were probably already on the net talking to the AWACS to either secure more fuel or call in some A-10 aircraft to locate their downed squadron mates. For this reason, he was confident there would be a search and rescue (SAR) effort mounted to extract them. He just didn't know how long it would take.

a continuation or completion bill for these projects is created in the outyears. As a result, the potential is great that other approved and funded programs in the Air Force modernization account will be forced to source some or part of the continuation of these disconnected multiyear new start projects. This continuation or completion bill is referred to as *somatic* instability (instability that becomes ingrained within the body of the resource allocation process as a result of the kickoff of these completely unfunded multiyear new start projects). There are also occasions when the Air Force receives congressional plus-ups for a multiyear new start only to find that, after starting the effort, there are unplanned and unexpected program costs that exceed the available plus-up funding. The Air Force is then forced to source these areas of cost growth from existing modernization accounts. This research refers to this form of instability as *acute* (instability resulting from the sudden need to source areas of costs that were not planned but could have been predicted). There is an element of acute instability, of course, resulting from cost that just could not have been foreseen under any circumstances. Instability caused by that type of cost growth is just a fact of life. The only way to really plan for it is to budget some level of management reserve for *unknowns*. These forms of instability represent the challenge addressed in this article.

The B-2-Specific UPL

In addition to the official Air Force UPLs for FY99-01, there were other venues through which the Air Force identified its unfunded requirements. In FY99-01, the Air Force provided Congress with B-2-specific unfunded requirements. Additionally, in FY01, the Air Force forwarded to Congress a supplemental UPL. It is not unreasonable to expect other unofficial exchanges of information that resulted in Air Force unfunded requirements being provided to Congress (for example, congressional inquiries from professional staff members for specific programs). None of these exchanges of information approached the constancy and codification of the official Air Force UPL and B-2 priority list. In fact, to ensure Congress continues to receive the B-2 priorities, the FY01 Authorization Conference Report (Section 131) added the following annual reporting requirement.

> By 1 March, SECDEF to submit annual report to Congress on B-2 aircraft identifying and assessing: (1) adequacy of average MC [mission capable] rate; (2) adequacy of technical capabilities; (3) planned development of technologies to enhance B-2; (4) additional capabilities that would enhance B-2 capability and survivability; and (5) a fiscal program for technologies identified in #3 & #4.[17]

Analysis Part II: The Scavenging Predators

They leave us so to the way we took,
As two in whom they were proved mistaken,
That we sit sometimes in the wayside nook,
With mischievous, vagrant, seraphic look,
And try if we cannot feel forsaken.

— Robert Frost

Taking Stock

Now that they were situated, Jeff took inventory of the resources he would be using. Through these mechanical actions, oddly enough, he experienced a calming effect. He quickly discovered he had a few things going for him. Jeff's survival pack was equipped with a radio. If it was operating okay, he knew it would serve as their lifeline to any search aircraft in the area. He also had a small measure of self-defense capability in the form of their 9-millimeter handguns and a little extra ammunition. They had only the small quantity of water and food that came standard with their survival packs, but he did have a signal mirror; flares; and most important, a signal strobe with an infrared lens cap. Jeff knew, with the approaching nightfall, the infrared strobe might be the difference between getting picked up before morning and getting captured. He thought, "When you're going through survival/evasion/resistance/escape (SERE) training, you never really think about having to use the stuff they teach you." For most guys, SERE training was like car insurance. You take it because you have to, but most of the time, you're counting on never needing it. Now, he would have to rack his brain to try and remember all the stuff he had learned. The thing that kept coming back to him was that he needed to never lose sight of his primary objective—getting out alive. That is, he would have to muster all his resources to help the SAR team locate them while, at the same time, remaining concealed from the bad guys. Slade didn't look well at all. He drifted in and out of consciousness, never really being able to put together any coherent statements. Jeff had no real medical training but recognized Slade had a compound fracture of his left leg and minor burns and lacerations on his face and neck. Jeff was gravely concerned Slade might have also sustained some internal injuries. Scared for the both of them, Jeff hoped the wait wouldn't be long, especially for Slade's sake. Once he had his buddy out of sight in a relatively safe place, he immediately went for his radio to make contact with any search aircraft in the area.

According to Czelusniak and Rodgers,

> . . . in comparison to estimates at Milestone II, major weapon systems have experienced about 25-percent cost growth at program completion . . . . It has been estimated that as much as half of the cost growth in major weapon systems is due to nothing more than funding instability (reallocation of funding to other near-term priorities external to a program). These kinds of repeated funding excisions ultimately lead to sizable program cost growth. This growth contributes no added value whatsoever to the system being developed/produced.[18]

Czelusniak and Rodgers go further,

> One analysis estimated the Department of Defense loses about $5B per year in investment program content due to cost growth. In real terms, this represents the value of material we were unable to acquire for our warfighters.[19]

Resource Allocation Fratricide

Even funded modernization programs generate instability bills. As DoD endeavors to develop and field cutting-edge technologies, it is an inescapable fact the risks that come with pursuing these capabilities can, at times, generate program cost growth. That is the cost of doing this type of business. What this article concerns itself with are the instances when the Air Force knowingly pursues courses of action that will inevitably drive unfunded instability bills for the modernization account. It is the budgetary equivalent to the concept of fratricide spoken of in warfighting operations. For those unfamiliar with this term, fratricide occurs when the Air Force—through planning, lack of planning, actions, or inactions—inadvertently destroys or neutralizes its own resources with friendly fire. In understanding the nature of the instability caused by inefficient execution of the UPL, it helps to visualize it in terms of *resource allocation fratricide* (Figure 2). As completely unfunded new start efforts are introduced through the UPL process, they bring with them somatic and/or acute instability bills. As these bills are sourced from existing modernization programs, there is increased program instability across the modernization account. Through this process, the Air Force, in essence, calls in strikes on its own position.

Air Force UPL (FY99)

The official Air Force FY99 UPL contained 14 entries requesting an additional $2.6B.[20] Of the 14 entries, only 2 were modernization initiatives. Neither entry was a multiyear new start project and, therefore, does not fit the criteria for examination.[21]

B-2 UPL (FY99)

There were several congressional inquiry responses, testimony and hearing question responses, and briefings that helped Congress identify B-2 FY99 unfunded priorities.[22] To that end, there was no single FY99 B-2 UPL. However, when the dust settled, the list of unfunded priorities for the B-2 consisted of five unclassified projects considered for this article. Of those five, three were multiyear new starts, and only one of those received congressional plus-up funding (B-2 deployable shelters).[23] The shelter program received $13.7M to begin this effort, carrying with it a completion funding tail of $25.9M across the FYDP (somatic funding instability).[24] The Air Force has yet to fund any of the completion bill for this effort, leaving it in a risky position. If the program does not receive additional plus-up funding from Congress or the Air Force, it will have to choose from three options:

1. Kill the program (wasting a sizable congressional investment).
2. Take resources from other funded programs to continue the effort.
3. Reduce the requirement for shelters.[25]

Whatever is decided, the fielding of any shelters carries with it an operations and maintenance (O&M) support tail that could be as much as $400K per year (FY02-07).[26] Without congressional add funding, the Air Force will have to source this shortfall from other approved programs. Figure 3 shows how big the potential shelters instability will be if the program does not receive additional congressional funding and the Air Force does not reduce shelter quantities.

Air Force UPL (FY00)

The official Air Force FY00 UPL contained 42 entries requesting $2.59B beyond the PB request.[28] Of the 42 entries, 20 were modernization initiatives. Of those, only two were multiyear new starts receiving plus-up funding from Congress.[29] The two projects were B-52 radar upgrades and a B-2 Link 16. Congress added $9M to B-52 radar upgrades, which accelerated the start of the Situational Awareness

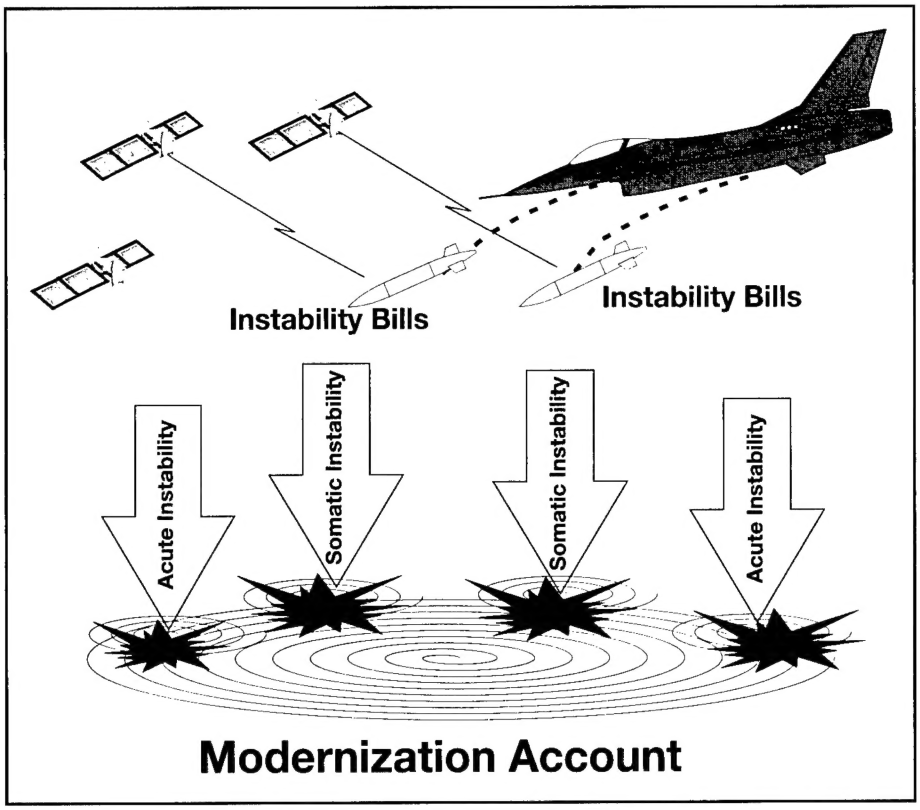


Figure 2. Resource Allocation Fratricide

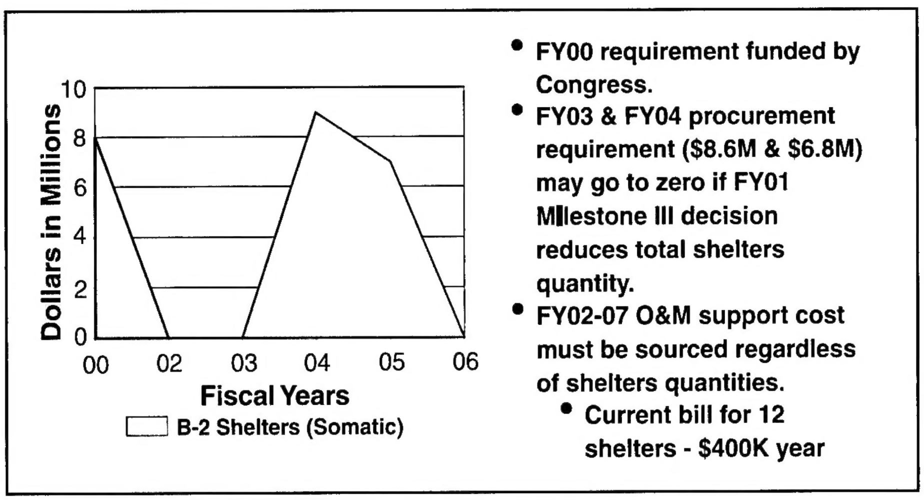


Figure 3. FY99 Projected Instability Bill[27]

Defensive Improvement (SADI) program from FY03 to FY00.[30] While this program was not a completely unfunded, multiyear new start (one criterion for consideration here), it was so disconnected financially in the outyears that it was worth including. The addition of the FY00 funds by Congress forced the Air Force to close the funding gap that existed in FY01 and FY02, while fixing some of the disconnects in FY03-04.[31] The congressional add in FY00, therefore, drove an Air Force bill of $61.9M from FY 01-04, which was taken from other approved Air Force programs.[32]

The Link 16 Center Instrument Display (CID) program, the second of the two Air Force FY00 UPL projects addressed in this article, received a congressional plus-up of $36M to begin work.[33] At the time of the FY00 PB, the potential completion bill for this effort was estimated at $154M across the FYDP (somatic funding instability).[34] The program has since been combined with the in-flight replanner (IFR) program, further increasing the estimate for completion.[35] In keeping with the trend in B-2 plus-up programs, the Air Force has yet to fund the completion of this effort, forcing it to live year to year on congressional adds.

B-2 UPL (FY00)

Through what has become a very interesting *push/pull* dynamic between Congress and the Air Force concerning B-2 unfunded priorities, the Air Force provided Congress a B-2-specific UPL in FY00. It was promulgated through a series of briefings to Defense Committee professional staff members.[36] There were two unclassified efforts on the list, Link 16 CID and Enhanced Guided Bomb Unit 28 (EGBU-28) integration. Both were multiyear new starts.[37] EGBU 28 received a $16.8M plus-up to start in FY00. The program initiation brought with it a potential completion funding tail of $20.9M spread across FY01 and FY02 (somatic funding instability).[38] The Air Force has yet to fund the completion of this program. Additionally, weapon interface challenges and risk reduction requirements generated $20M in acute funding instability bills in FY00-02.[39] The Air Force has sourced $2M and $3M of this bill, respectively, from other modernization programs in FY00 and FY01.[40] These instability bills equate to deferred or lost combat capability or program content for other modernization activities.

Before moving on to discussions of the FY01 UPLs, it is worthwhile to talk briefly about the B-2 IFR program, which has been combined with Link 16 CID. It is unique as a multiyear new start program also begun with congressional plus-up funds. However, it was not identified through the official Air Force or B-2 UPL. The prime contractor for the B-2, Northrop-Grumman, has historically forwarded its own UPL to Congress each year. It is believed Northrop's list contained the IFR and other efforts.[41] Details are sketchy as to what the completion funding bill was for IFR at the time it received its initial plus-up. Now that it has been combined with Link 16 CID, it is all but impossible to break it out. The program was started in FY00 with a $20M plus-up from Congress and was again supported in FY01 with another congressional add ($11M).[42] Given that the Air Force has not provided completion funding for this program, if Congress does not continue to support it each year with plus-ups, the Air Force will have to terminate it prior to realizing the

capability. The other option is to source its completion bill out of hide (somatic instability). Figure 4 identifies the size of the actual or potential instability bills associated with FY00 UPLs.

Air Force UPL (FY01)

The Air Force FY01 UPL contained 62 entries requesting an additional \$3.51B beyond the PB submission. Of those, 37 were modernization projects, of which only 3 were congressionally supported, multiyear new starts. The three were Extended Range Cruise Missile (ERCM), Fixed-Target Miniaturized Munitions Capability (MMC), and Bearing Only Launch (BOL)* countermeasures.[44] Of interest is the fact the Air Force simultaneously funded the completion (or start, if required) of the ERCM and MMC programs in the FY02 budget before knowing definitely if Congress would support the respective UPL requests for these programs.[45] This deliberate planning eliminated the potential and actual somatic funding instability that typically comes with starting multiyear new starts initiated without the means to continue or complete them. While this funding strategy avoided somatic instability, it could not prevent the occurrence of an acute funding bill associated with MMC. The MMC shortfall was a result of Congress providing \$5M less than the amount identified by the Air Force to start the program. The program plans to address the shortfall through internal Air Force reprogramming.[46] By definition, the reprogramming of these funds will contribute to modernization program instability.

The F-15 BOL infrared (IR), chaff-and-flare dispenser program was started in FY01 with a congressional plus-up of \$34.5M. Of this, \$7.6M funds integration of the system on the F-15 A-E models, while \$26.9M procures hardware capability for Air National Guard F-15A/B aircraft only. While the Air Force identified a completion tail of \$100.6M across the FYDP, this is not a bill that will necessarily be realized.[47] If it is not funded, it will mean the active Air Force F-15 C/D/E models will not receive the BOL hardware capability.[48] This is not a *must pay* bill. While this modernization upgrade strategy used to procure BOL avoids somatic funding instability, it does not protect the Air Force from acute funding instability bills. Most likely due to the lack of time available to develop complete program estimates and lack of information at the time the program was costed out for UPL candidate submission, the program failed to plan for the cost associated with procuring expendables (to meet full funding requirements), higher integration contract costs, trainer and simulator updates, tactics development, and updates to the Air Force Mission Support System.[49] These oversights have generated at least \$4.2M in acute program cost growth for FY01-02.[50] In all fairness to the F-15 system program office (SPO), the cost estimates developed to support the BOL entry on the UPL were developed in a hurried fashion, initially to address a telephone inquiry from a congressional staff member. When estimates are put together in such a high-pressure, rapidly moving environment, it is difficult to adequately plan for or foresee all aspects of costs associated with a new effort

B-2 UPL (FY01)

In March 2000, the FY01 B-2-specific plus-up priorities were submitted to Congress. The list included Link 16 CID/IFR, EGBU-28 integration, extra high-frequency (EHF) risk reduction, and fixed-target MMC.[51] To achieve unity of effort, the B-2 list was consistent with the Air Force UPL, with the exception of IFR.[52] Additionally, the Air Force worked closely with Northrop-Grumman to ensure they did not approach the Hill with differing priorities.[53] With the exception of MMC, each of the programs identified on the B-2 list were either not supported by Congress (EHF) or started with plus-ups in previous years. They, therefore, are not considered new starts for FY01, eliminating them from analysis for that year. MMC's contribution to FY01-based funding instability was discussed. Figure 5 identifies the size of the actual and potential instability bills associated with FY01 UPLs.

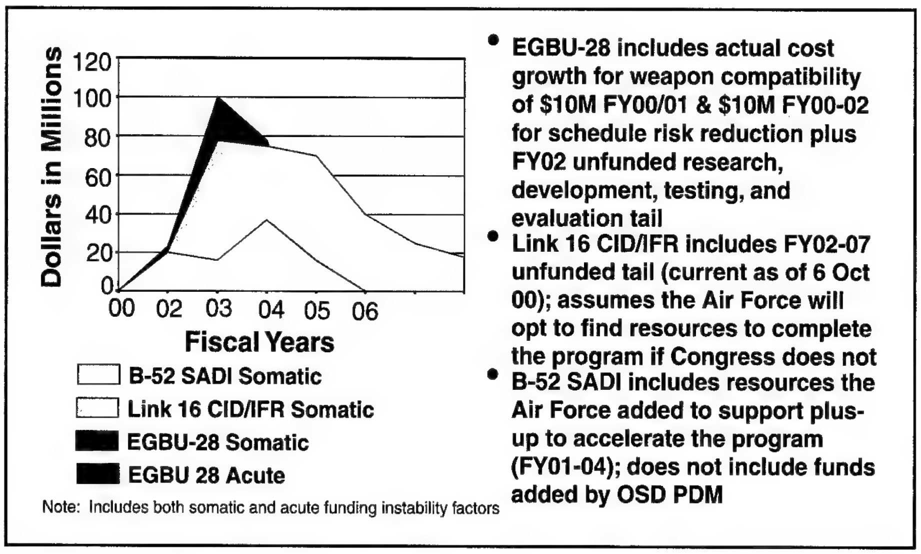


Figure 4. FY00 Projected and Actual Instability Bill[43]

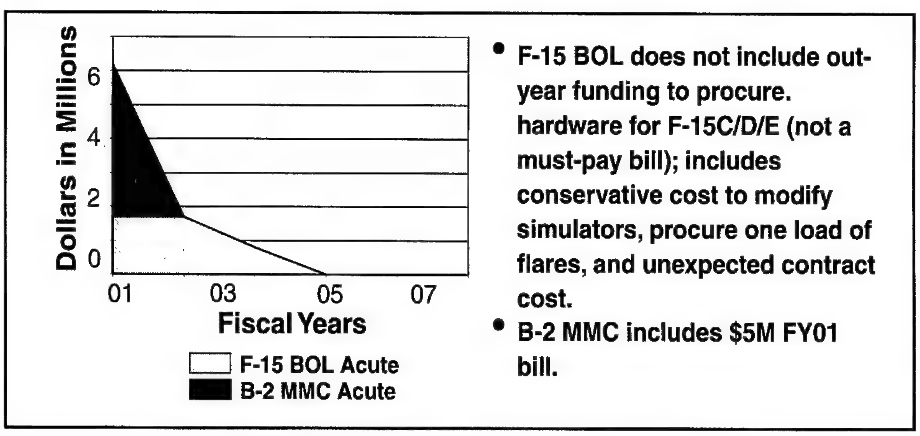


Figure 5. FY01 Projected and Actual Instability Bill[54]

Seek and Find: 1745 Hours

As the shadows grew long on the desert floor, what had once been stifling heat was now becoming somewhat bearable. As near as Jeff could figure, he and Slade had been on the ground for a little over an hour, but it had seemed more like 8 hours. After securing their evasion camp, Jeff went to work. He pulled out his global positioning system (GPS) to get a fix on their location. Relaying their exact position using the GPS coordinates would be crucial to any rescue mission. The challenge would be to relay their position to the SAR team without revealing their location to the Iraqis, who would invariably be listening to nonsecure American voice communications. Ordinarily, this would be a huge obstacle to overcome; however, once again, fate smiled on Jeff and Slade. During their pre-mission briefs,US pilots are provided a coordinate to use as a frame of reference when communicating with their standard nonsecure radios on the open airwaves in the event of a shootdown. Known as SARDOT, aircrews use this coordinate to relay their ground position. They do this by transmitting their heading, direction, and distance relative to the SARDOT. Since any bad guys listening in did not know the coordinates of the SARDOT, even if they overheard the radio communications, they would not be able to pinpoint the downed aircrew. Jeff turned on his radio and was pleased to find it working. He thought, "God bless those life-support bubbas that keep our gear in good working condition. I'm buying them all drinks when I get back . . . if I get back." Jeff's attention then turned to dialing in the predesignated emergency frequency or freq as they liked to say. The first friendly voice Jeff heard was that of an A-10 pilot, Captain Mark Pruitt, call sign Sandy-13. Mark's wingman, in a second A-10, kept silent while he did the talking. Jeff authenticated Mark and then commenced to relay their position using the SARDOT. Captain Pruitt gave Jeff explicit instructions not to break radio silence again until he contacted Jeff and authenticated his identity. These directions would prove important to Jeff and Slade's remaining safely hidden from any hostiles in the area who might be listening in. Sandy-13 then relayed Jeff's coordinate information to the AWACS platform operating in the area. In the final analysis, the AWACS was crucial in providing key command and control information for the SAR effort. Within minutes, Jeff could hear the thunderous sound of A-10s in the distance. When they got within 2 miles of Jeff's coordinates, Sandy-13 worked closely with him to covertly pinpoint his exact location. This allowed the A-10 to confirm Jeff's position without giving it away to the enemy. As the A-10s made their pass, they looked for ground and air threats. What they saw as they popped over a nearby hill would make them glad they had stuck to standard rescue-and-recovery protocols. The situation was graver than they had imagined. There was a ground radar site about a mile south of Jeff's evasion base. Approximately 2 miles to the southwest, there were heavily armed ground forces parked at a refueling station. The A-10 drivers immediately recognized the small convoy as an Iraqi search team. They, undoubtedly, were looking for the downed aircrew. The A-10 pilots knew the stakes had just been raised for the SAR mission. This would be far from a permissive extraction environment. The A-10s left the area to contact the AWACS with their latest reconnaissance information. With the SAR team at least an hour away at this point, they didn't want to loiter in the area and risk giving away Jeff and Slade's position. They did, however, need to remain close enough to keep an eye on the nearby Iraqi ground element in case they managed to locate the downed Americans. In the event of that occurring, the A-10s would lay down strafing fire to defend Jeff's position. The SAR team would have to work fast to get the guys out before the Iraqis found them. Even though the radio was now silent, just knowing the A-10s were close by gave Jeff a mild sense of comfort. While they waited, Jeff did his best to keep his WSO hydrated. When Slade drifted into consciousness, he would force him to drink a few sips of water. His WSO was in a bad way and needed medical attention in a hurry. Jeff had hoped they would be rescued quickly but was prepared to settle in and wait it out. He recognized that, since they were shot down in southern Iraq, any SAR mission would be mounted out of Al Jabbar by the Air Force Combat Search and Rescue (CSAR) unit there. Jeff knew those guys were good at what they did, and if anyone could get them out, they could.

Findings: Seek Eagle

God brings men into deep waters, not to drown them but to cleanse them.

—Aughery

Why has the Air Force chosen to continue allowing Congress to fund B-2 modernization with annual plus-ups? Why does the Air Force place multiyear plus-up programs on its UPL and not lay in funding for program continuation/completion? Why does the Air Force have no method for specifically tracking (through direct links) how one program's somatic and/or acute funding instability impacts other funded modernization programs? While these and other questions could not be answered, there are some interesting findings worth noting.

Unfunded Requirements

Two separate Service Chiefs have spoken to Air University audiences recently about a *procurement bathtub* or what some might call a *procurement holiday*. One of the Chiefs spoke of a 10-year period following the Vietnam War during which the DoD's infrastructure and equipment were not properly maintained or replaced (procurement holiday). As a result, the infrastructure and equipment fell into disrepair. At the end of the 10-year spending drought, there was a huge deficit in infrastructure and modernization. This became known as the *procurement bathtub* or *capabilities bathtub*. According to one speaker, the Air Force is still trying to overcome that spending deficit today.[55] The Air Force has attempted, through the annual PB request and UPL, to abate these readiness and infrastructure deficits, with the ultimate objective being to reverse them. This must be done while continuing to make the right investments to modernize the force.[56] To that end, the UPL has shown itself to be an extremely valuable tool for highlighting significant unmet needs to Congress.

Quantifying the Challenge

This article has highlighted how certain UPL multiyear new start projects have contributed to acute and/or somatic funding instability within the modernization account. It has also identified the definition of preferred UPL candidates (completely unfunded

efforts), which, if followed exactly, would create significant completion funding bills for the Air Force. If the research were to end its discussions on those points, it would be easy for those unfamiliar with the Air Force resource allocation process to assume the existence of a really big problem. The truth is, research did not bear that out. In fact, what was clear from the research is that, across the years examined (FY99-01), the Air Force annual UPL request has increased steadily from roughly $2.6B to $3.51B.[57] Similarly, each successive year's UPL grew in the number of projects included. However, interestingly enough, the occurrences of congressionally approved multiyear modernization new starts did not grow at the same pace. The amount of funding requested through the official Air Force UPL stayed roughly the same from FY99 ($2.6B) to FY00 ($2.59B). The large increase occurred from FY00 ($2.59B) to FY01 ($3.51B), roughly a 36-percent increase.[58] The number of total items submitted on the official Air Force UPL grew steadily from 14 in FY99, to 42 in FY00, to 62 in FY01.[59] This represented a 200-percent increase from FY99 to FY00 and a 48-percent increase from FY00 to FY01. The number of congressionally approved, multiyear modernization new starts on the official Air Force UPL was zero in FY99, two in FY00, and three in FY01.[60] When examined from this perspective, one can see the problem is not significant or by any means pervasive.

A look at the B-2-specific UPL reflects a net decrease in items identified and funding requested, albeit not steady. In FY99 the B-2 UPL requested $217.5M. In FY00, it requested $61.3M (a 255-percent decrease from the previous year). In FY01, the B-2 UPL requested $108M (a 76-percent increase from the previous year, down 101 percent from FY99).[61] An examination of the number of projects identified by year similarly points to a net decrease. As the numbers descended, they fluctuated from six in FY99 to three in FY00 and back up to four in FY01. The amounts requested for the B-2 represented only 8, 2, and 3 percent, respectively, of the total Air Force UPL requests for FY99, FY00, and FY01.[62] When placed in this context, one can see, once again, that, while the greater likelihood is the B-2 list will generate outyear bills, actual total numbers of requests and dollars requested is just a small piece of the Air Force's UPL pie. To fully understand the magnitude of the challenge, it is important to examine the causal factors for the two components of funding instability (somatic and acute). The logical question is, what causes these two very different forms of instability?

Causal Factors (Somatic Funding Instability)

Starting multiyear projects before continuation or completion funding can be proactively identified as the primary cause of somatic funding instability. This form of reactive resource allocation undermines the deliberate planning and prioritization that takes place within the MAJCOM POM development and Air Force corporate process, budget formulation.

Causal Factors (Acute Funding Instability)

Again, acute funding instability occurs during the management of a program when a need suddenly arises to source an *unplanned* area of cost that could have been anticipated. Of course, there are instances when acute costs arise that just could not have been foreseen under any circumstances. To be fair, it should be mentioned that acute funding instability is not unique to multiyear new start UPL projects. It can occur within fully phased, planned, and programmed modernization programs. It seems the component of acute funding instability that can be anticipated is caused more often than not by two factors: incomplete, rushed, or abbreviated phasing of programs and the lack of review of UPL submissions by trained analysts. The UPL projects are not typically fully phased, planned, and programmed when submitted. The funding identified for these projects is most often generated as a rough order of magnitude (ROM) estimates by Air Force program offices or the developing defense contractor.[63]

Managing Congressionally Funded Multiyear New Starts

B-2 instability bills have been termed *potential bills* because the B-2 program office has taken steps to build in cost-avoidance *off ramps* for the Air Force should its UPL projects not receive continuation funding. This prevents the occurrences of *must pay* completion bills for the Air Force.[64]

More in-depth research has revealed the B-2 SPO has done well to adapt to a very uncertain modernization-funding environment. To characterize their challenge, 10 of 18 upgrades (not including low-cost modification projects) presently under way were initiated with congressional plus-ups. Of those ten started with congressional adds, only three have funded completion tails.[65] To that end, the SPOs have been very careful to ensure the existence of off ramps in their multiyear plus-up projects in the event Congress and/or the Air Force does not fund the next year's continuation requirement. The projects can be terminated without the Air Force's owing major termination liability payments to the contractor or completing the entire development initiative, while also allowing the Air Force to receive a deliverable (end product). That deliverable usually takes the form of a study report.[66] This form of contingency program management is a logical evolutionary step given the uncertainty that comes with depending on incremental annual congressional plus-ups to complete programs. While this form of program management is clearly an attempt to mitigate risk, it is inherently risky. Even programs managed in this way to avoid large somatic instability bills (completion funding tails) at times still contribute to funding instability in the Air Force modernization accounts. Take for example the B-2 satellite communications (SATCOM) and alternate high-frequency materials (AHFM) programs. Both were multiyear new starts that began in FY98 with congressional plus-up funding.[28] Both have been managed similar to the process cited above and experienced tremendous acute cost growth. These areas of cost growth were caused by optimistic cost estimation, contractor rate increases, and a failure to anticipate integration difficulties with other necessary developmental items (for example, SATCOM radio).[67] While efforts have been made to mitigate risk, obtain additional plus-up funding from Congress, and live within available funding, there has been cost growth in both these projects (FY20 and FY01), requiring the B-2 program to dip into its baseline program to fund a portion of the

growth. One recent example of acute funding instability identified during this research showed the SATCOM program to be responsible for the migration of \$.074M (FY00) and \$1.697M (FY01) from the B-2 baseline account into this plus-up project. The AHFM program was responsible for migration of \$1.767M from the B-2's baseline account into this plus-up project during the same time period.[68] While the B-2 SPO should be applauded for attempts to manage its plus-up projects in this uncertain environment, it goes without saying it is less than fiscally responsible and extremely inefficient for the Air Force to manage a program this way. In the case of the Link 16 CID/IFR program, the Air Force actually has waited as late as possible each fiscal year to obligate congressional plus-up (continuation funds) with the hope of finding out if Congress and/or the Air Force will fund the next year's continuation requirement. This adds risk to program schedules while inefficiently stretching out the program's completion.[69] If Congress fails to continue to provide incremental funding, the Air Force will have to terminate the program. Termination of the program would mean the Air Force would not realize the Link 16 CID/IFR capabilities. In addition to not obtaining the needed capability, it is easy to see how some might view the startup and subsequent termination of the program as a waste of significant congressional investments (FY00-\$88.7M and FY01-\$11M) just to obtain a study report and/or some building-block technology that can be applied to follow-on programs (EHF).[70]

Why does the Air Force continue to depend on Congress to incrementally fund the completion of B-2 UPL projects given the risks? No definitive answer surfaced during research. There have been those, who wish to remain anonymous, who have speculated the Air Force takes this approach as a shrewd means to pursue and protect as many of its investments as possible in what has been a very lean and constrained budget environment. Since Air Force requirements significantly exceed available funding, it funds those things it must do and, at the same time, identifies unfunded requirements for those initiatives it knows Congress will not allow to go unfunded because of their importance to their supporters. In that purely hypothetical scenario, the Air Force stands a greater chance of obtaining funds for things submitted not only in its approved PB submission but also on its UPL. This discussion of congressional involvement leads us to relations with Congress.

Relations with Congress

Many Air Force development and modernization programs, to include UPL initiatives, have strong lobbies. These lobbyists work hard to encourage Congress to support their respective programs with plus-up funding. The peculiar relationship between these lobbyistS and inherent congressional interests (potential to provide jobs and revenue for congressional districts) creates an interesting dynamic that impacts the funding of UPL projects. It was mentioned that Northrop-Grumman, in years past, forwarded its own B-2-specific UPL to Congress with the hope of obtaining additional funding for the program. Similar lobbying also occurred with the BOL IR program, the joint standoff weapon (JSOW) program, the sensor-fused weapon program, and a host of others. It is the nature in Washington that defense contractors often use lobbyists in attempts to obtain additional funding for programs, even if these programs are not priorities for the Services. While not specifically covered in this article, it is important to highlight this dynamic here so the reader might know there are other sources (not just the Air Force or B-2 UPLs) that contribute to somatic and acute funding instability within the Air Force modernization account.

Best Employment of the UPL

Earlier, this article identified and explained the overlapping nature of the budget cycle. It pointed out it is all but impossible for the Air Force to take a serial approach to deciding if resources should be invested to continue a UPL program currently under consideration by Congress. By the time Congress makes a final decision on whether a UPL project will be funded (August/September), the Air Force budget has already been submitted to OSD as the BES. At that point, it becomes extremely difficult to make changes to the working budget to account for congressional decisions on the previous year's budget being appropriated concurrently. For completely unfunded UPL initiatives, this means Congress could fund the program start, while the next year's requirement for that program remains unfunded by the Air Force. This, of course, is a recipe for funding instability. It has been said Air Force programmers are told to specifically disallow programs that might drive outyear bills from competing for UPL funding. In an attempt to find official guidance supporting this rumored *gatekeeping* rule, the author contacted the Air Force Directorate of Programs. It was not possible to find official operating instructions used by programmers to develop the UPL. The existence of this gatekeeping rule of engagement could not be substantiated. Thus, assuming the Air Force will continue to allow completely unfunded, multiyear new starts to compete for UPL funding, the best approach to pursuing them is through a simultaneous effort. When the Air Force places a program on the UPL and simultaneously lays in funding in the next year's budget, that will either allow the program to continue (assuming UPL funding is received) or start (assuming no UPL funding is received) the following year. This approach allows the Air Force to avoid situations where programs are initiated with congressional plus-up funding but do not have funding in successive years for completion. While this does not eliminate the possibility for acute instability, which occurs in both UPL and also planned/programmed Air Force modernization programs, it does all but eliminate the occurrence of somatic funding instability (instability caused by the need to source unfunded completion funding tails).

Completely unfunded UPL projects do not go through the normal process of being planned and programmed through the Air Force POM and resource allocation processes. Therefore, these efforts can be initiated through congressional plus-up funding before adequate tradeoff decisions can be made as to what capabilities will be discontinued to pursue the new UPL initiative. The difference or distinction between starting a program through MAJCOM POMs and starting a completely unfunded program through the UPL is that the POM initiative is done proactively, taking into consideration requirements tradeoffs and funding

solutions. Completely unfunded programs started through the UPL tend to be unexpected additions or windfalls to the *great requirements table*. Once Congress funds their initiation, these UPL initiatives place the Air Force in the reactive position of attempting to determine what must go unfunded to keep the new UPL project alive. In a constrained budget environment, this can force the Air Force into making premature requirements tradeoff decisions in a sequence of events that may or may not involve all the right agents and stakeholders.

One of the primary causes of acute funding instability is UPL programs do not generate budget-level, cost-and-schedule data, and these projects do not receive the normal review and scrutiny by Air Force budget analysts and program element monitors or OSD comptroller personnel. If simultaneous budgeting occurs (submit first year's funding requirement through UPL while simultaneously funding the program in the next year's budget formulation process), the program has the benefit of the budget data formulation and review processes. This goes a long way toward reducing significantly acute funding instability. In addition to reducing the occurrence of funding instability, simultaneous budgeting also signals to Congress the Air Force commitment to the UPL initiative. Typically, professional staff members for the defense committees forward the Air Force clarifying questions about UPL programs. One of these is, "How much additional funding would be required by the Department of the Air Force to complete the project, either in subsequent fiscal years or to satisfy the fiscal year XXXX (budget year), such as in-house Department of the Air Force costs?"[71] Another is, "Is funding for this project included in the current FYDP? If so, provide the current FYDP quantity and funding profile and provide the best estimate of what the revised FYDP quantity and funding profile would be if the proposal were implemented"[72] These questions point to the fact that Congress is interested in the amount of continuation funding required to completely finish unfunded, multiyear new start projects and the Air Force is willing to commit to addressing the associated outyear bills.

Near Miss: 1830 hours

During the radio silence, Jeff worked hard to conceal their position. With the limited brush available, he covered their hiding place in the cleft of the rocks. As he was repositioning their camouflage, he heard what sounded like a truck engine. It was a jeep, and it was close. For the first time, he could see the enemy, and they were Iraqis. The two men in the jeep were close enough that Jeff could hear them speaking in Arabic. The jeep was a scout, and it was heading in the direction of the downed F-15. Jeff could see smoke rising from the lifeless hulk that once was his chariot. The wreckage was about 2 miles north of their position. Jeff knew this was serious. Once the Iraqis got to the wreckage, it wouldn't take long for them to notice the canopy and ejection seats were missing. It would then be an all-out race to find the downed aircrew. Sandy-13 and his wingman were keeping a close eye on the lone jeep. It had stopped within a quarter mile of the Americans' hiding place. The Sandies prepared to take out the jeep, but as they did, the jeep moved on toward the F-15 wreckage, oblivious to the fact that their ultimate objective had actually been within spitting distance of them. The Sandies rolled off their target realizing it was just a coincidental near miss. When the sun was going down, the area within a 5-mile radius of Jeff's location was abuzz with activity. The Sandies were doing their best to conspicuously keep a close eye on the Iraqi ground movement in the vicinity. Captain Pruitt would later recount how utterly amazed he was at how poor a job the Iraqis did at locating the downed Americans. They seemed to be looking everywhere but in the obvious location of the rock outcropping that had become Jeff and Slade's sanctuary. That was okay with Pruitt. As long as the Iraqis stayed away from Jeff and his WSO, the Sandies would not have to take any direct action against them. It would soon be dark. Darkness would work for the downed aircrew by providing additional concealment, but it would also complicate the rescue mission. With darkness bearing down on Jeff and Slade about the same rate at which the SAR team was approaching, night vision technology would be crucial to the success of the mission. Recognizing that darkness would be their enemy, the Iraqis pulled out the stops and mounted an all-out search for the downed American pilots. Vehicles appeared to be moving in every direction, combing the desert floor for Jeff and Slade. Who would find them first, the SAR team or the Iraqi patrol?

Conclusion: Recover Talon

To every man, there comes in his lifetime that special moment when he is figuratively tapped on the shoulder and offered that chance to do a very special thing, unique to him and his talents. What a tragedy if that moment finds him unprepared or unqualified for that work.

—**Winston Churchill**

Context

The Bush administration is pursuing a significant federal income tax reduction plan. Further, this administration's defense agenda includes national missile defense, theater missile defense, modernization and bolstering of the bomber force, and a substantial increase in nomenclature security. All this comes at a time when the Pentagon is heavily engaged in tactical air (TACAIR) modernization, pursuing the F/A-18, F-22, and joint strike fighter programs. In addition to TACAIR, the Pentagon has recognized the need to increase its military airlift capability through the purchase of more C-17s. These things are being pursued as the nature of warfare is changing. Over the last decade, society and the global community have become extremely casualty averse. Facilitated by the *CNN Factor*, there has been an increased demand for the military to utilize more precise, smart, and standoff weapons in order to minimize casualties on both sides. The Air Force's recent involvement in Operations Allied Force and Enduring Freedom provided some indication of the number of weapons that should be on hand to prosecute a sterile and standoff style of warfare. Future operations similar to these will require a significant investment in programs like ERCM and MMC. Even by conservative measures, it is not unreasonable to expect requirements will continue to outpace available resources for some time. This brings one full circle back to the notion the Air Force must continue to be vigilant

in its efforts to efficiently allocate and execute its fiscal resources.

Correlation Challenges

This article examined potential and actual instability bills created by Air Force management of the UPL process. It has been impossible to isolate a specific cause-and-effect relationship between one program's instability bills and another's loss of content due to the nature of the Air Force's sourcing process. If a *must pay* bill is identified, it is distributed to each of the resource panels based on its individual share of the Air Force total obligating authority (TOA). For example, if the Global Attack Panel has been allocated 38 percent of the Air Force TOA for the budget cycle in question, it will be asked to source 38 percent of a must-pay bill that surfaces. Likewise, the Command and Control Panel will be asked to source 5 percent of the bill, given its allocation of TOA for the budget cycle is 5 percent. Within a particular resource panel, several programs may end up contributing to a sourcing drill. Adding to the sourcing drill fog is the fact most drills are typically designed to source several bills at once. The multiplicity of sources and disconnected programs playing in the same sourcing drill make it difficult to trace one directly to another.[73] For example, assume the following programs have must-pay bills and will be the beneficiaries of a sourcing drill: SATCOM terminals (need $15M), F-22 (need $4M), airborne laser (need $20M), and Joint Direct (need $3M). The following programs are identified as sources by their respective resource panels: F-15 radars ($12M), F-16 600-gallon tanks ($20M), JSOW ($1.5M), Joint Stars ($1.5M), KC-135 modifications ($3M), and common avionics equipment ($3M). From the example, it can be seen that all the sources go into one big sourcing pot and the dollars are mingled together. The disconnected programs draw from this pot to meet their needs. As a result, the impacts of sourced programs' losing their funds (and they typically are negative impacts) cannot be traced to one specific receiving program's need. Therefore, it is next to impossible for Air Force leadership to know definitively that the SATCOM terminals program was fixed at the expense of 12 JSOW missiles. Some might argue that if the leadership were to make a macrorequirements analysis of funding tradeoff decisions the ability to tie a gain in capability directly to a sacrificial loss in another might change sourcing decisions.

So What?

Given the vague nature of sourcing, it was impossible to identify specifically which programs lost what content as a result of somatic and acute instability bills identified. However, to put a face on the effects of instability, actual impact statements were obtained from programs being considered for sources in sourcing drills over the last few years. This will give a better idea how the projected instability bills could affect funded Air Force programs

As can be seen in Table 1, the loss of as little as $1.5M to a program can result in significant operational impacts. In some instances, like with the WCMD example, the reduction in resources can break established contract minimums, which carry with them hefty penalties. Therefore, sourcing $1.5M out of WCMD may only mean an immediate loss of 60 weapons. In the long run, losing those 60 weapons drops the Air Force WCMD quantity commitment below a negotiated contract amount, further forcing the Air Force to renegotiate the contract in a sole source environment. During the renegotiations, the Air Force can expect to see unit costs for WCMD increase by as much as 15 percent. Given a fixed investment in the program, the Air Force would lose significant quantities of WCMD across the FYDP due to cost increases. But how can this UPL-induced instability be addressed?

Suggested Solutions

Addressing the UPL instability challenge could be accomplished through a three-step process: definition change and discipline in candidate selection, review of candidates by UPL program-phasing working group, and MAJCOM demonstration of commitment to candidates. The Air Force definition of the UPL and its criteria for UPL candidacy do not match actual performance data. According to the current definition, completely unfunded programs may be considered but not those underfunded or otherwise impaired.[75] In practice, the Air Force places accelerations and impaired programs on its UPL, in addition to those that are completely unfunded. The problem exists when completely unfunded programs are placed on the UPL and the Air Force does not endeavor to fund their completion tails. It is important to first change the criteria definition to reflect practice. Further, the Air Staff must let the MAJCOMs know only those completely unfunded projects that will be given *funded* status in the following year's MAJCOM POM submission will be considered for candidacy. The other option is for only those completely unfunded projects without funding tails to be allowed to compete for congressional plus-up funding through the UPL. In either case, discipline must be added to the candidate selection process and specific written instructions provided to those Air Force planners and programmers overseeing the process.

It is evident that UPL projects do not get the same level of scrutiny and review as fully phased programs examined by the Air Force, OSD, and OMB through the PPBS process. This is invariably true. To mitigate this shortfall, it is proposed that resource panels and/or a multidisciplined, integrated product team (working-level participants from Assistant Secretary of the Air Force, Acquisition and Financial Management and Comptroller; Air Force Deputy Chief of Staff Plans and Programs, Installations and Logistics, and Plans and Operations; and the Program Executive Office) review UPL candidate programs that make the pre-final list. The integrated product team should troubleshoot each candidate's funding stream and cost-estimate rationales for commonly overlooked areas of cost. For example, does the estimate capture initial and replenishment spares requirements, or does it consider requirements to procure technical data, training, and/or other operations and support? A more robust level of scrutiny, through the use of tools as simple as standard questionnaires and checklists, has the potential to reduce acute funding instability.

Finally, it is proposed that the MAJCOMs demonstrate their commitment to UPL items. The responsible MAJCOM should indicate, as it submits unfunded multiyear programs with its POMs, the ones it is willing to commit to funding during the next budget cycle (barring some

Captain James MacKenna, USAF
William A. Cunningham III, PhD
Lieutenant Colonel Raymond R. Hill, Jr, USAF

Inventory Leveling Within AMC

Determining AGE Levels

Requirements-Based Methodology

No maintainer wants to see aircraft mission losses due to a lack of functional AGE. Thus to mitigate the impact of potentially unreliable AGE, excess AGE inventory is the norm.

Problem

Aerospace ground equipment (AGE) is used to service aircraft while on the ground. The aircraft maintainer's job is to ensure aircraft are serviced and repaired expeditiously, thereby maintaining high percentages of the aircraft fleet in mission-ready status. The desire to have these high aircraft mission-capable rates has resulted in keeping high inventory levels of everything imaginable necessary to sustain the aircraft. No maintainer wants to see aircraft mission losses due to a lack of functional AGE. Thus, to mitigate the impact of potentially unreliable AGE, excess AGE inventory is the norm.

The level of AGE (or any support equipment) at a given location is determined by that location's table of allowance authorization. Currently, the Air Mobility Command (AMC) queries subject matter experts (SME) to determine the table of allowance authorizations for AGE. This is done base by base, with unit type codes and the mission requirements of each base determining the final total allowance authorization. As the Air Force enters the 21st century, it must reduce excess assets in the most effective manner possible.

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notable quotes

Let us hope that this story of another case of "too little, too late" will drive home a lesson to the people of this country. We must not again let our defenses down. The next time might be simply—"too late."

—General George C. Kenney, USAF

By closely examining what is actually required to support aircraft, the Air Force can identify excesses and shortfalls to obtain maximum utility from limited resources. Considering the reliability of AGE units is a major input into the number of units required due to potential reliability problems with either newly deployed or aging systems.

AMC Interest

AMC is purchasing a new nitrogen system, the Self-Generating Nitrogen Servicing Cart (SGNSC). The method AMC currently uses to determine AGE levels seems to overstate need, and the purchase of a new nitrogen system for use throughout the Air Force, with AMC as the lead command, is an excellent opportunity to compare current practice with a more analytical approach to determining AGE levels. The intent, of course, is to reduce AGE levels without impacting aircraft mission-capable rates.

Scope of Research

The primary purpose of research for this article was to define and demonstrate a methodology for assessing AGE utilization in a given scenario while noting any impacts on mission capability. The goal was to use this quantitative methodology to size an AGE fleet to meet aircraft demand at a base of study and perform sensitivity analysis on any maintenance delay if the aircraft must wait for AGE assets.

To analyze the impact of SGNSC and limit confounding effects of possibly redundant variables, variables such as maintenance and fuel were modeled as unconstrained resources.

The initial SGNSC contract was a $20M effort with an estimated 570 units at $35K each, not including operations and maintenance costs.[1] While it did not compare with the B-1 program, it did have potential for cost reductions and was worth examining. Further, these were procurement costs only and did not include other costs such as reliability, maintainability, and mobility or deployment.

This article does not examine the impact of other AGE on aircraft availability. It only addresses the impact of SGNSC through comparison of distributions of different variables against each through a queuing simulation to determine range of utilization and size of SGNSC inventory to accommodate mission requirements.

AGE

AGE is used for servicing and maintenance of aircraft on the ground and is a relatively inexpensive way to maintain aircraft compared to using systems on board the aircraft. It may be readily replaced without impacting aircraft mission capability. AGE is a necessary part of the flight-line environment, and some form of AGE is almost always used in the performance of aircraft maintenance.

SGNSC

SGNSC is a self-contained, powered AGE unit that uses outside air to refill nitrogen storage cylinders. The cart takes outside air, builds pressure, and filters nitrogen through a membrane into the storage cylinder. The nitrogen is retained in the cylinder until discharged. The system is entirely self-contained and does not require refilling from outside sources, saving time and money, while increasing safety.

LCOM

The Logistics Composite Model (LCOM) is a discrete event-queuing simulation. It was developed in the 1960s by the Air Force Logistics Command and the Rand Corporation to analyze maintenance processes.[2] In 1970, the Tactical Air Command used LCOM to determine maintenance manpower requirements for a squadron of F-4E aircraft. The end result, according to the final report—*proof positive* through the actual operational unit flying, a schedule developed through LCOM—was a valid model for determination of manpower requirements.[3] In 1992, the Aeronautical Systems Center (ASC) conducted a study for the F-15E Eagle Century Plus Radar Program. ASC combined this study with a validation effort for LCOM, which compared LCOM predictions with actual results. As can be seen from Table 1, the LCOM model conformed very closely to actual sortie rates and APG-70 actions, with the difference between the model and the real world close to or less than 1 percent..

LCOM results were also compared to F-15E operations at Luke AFB, Arizona, for a 56-day period with the results presented in Table 2. The results, again, were very close to the real world.

LCOM has been selected by numerous system program offices (SPO)—including but not limited to the B-2, F-22, joint strike fighter (JSF), and C-17 SPOs—for use in determining supportability requirements.[6] LCOM was formally accredited by the JSF SPO as a satisfactory supportability model to analyze sortie generation rate, manpower, support equipment and facilities, spares, prognostics and health management, cannibalization, and resource constraints.[7]

Current AGE BOI and Utilization

Interviews with AMC AGE personnel revealed the AGE basis of issue (BOI) is currently determined by subject matter experts with field experience. The SPO for the weapon system meets with the command headquarters AGE representatives and the AGE management agency from Robins AFB, Georgia. They review AGE usage at the bases where the weapon system is maintained and then negotiate the AGE table of allowances based on estimated future usage.

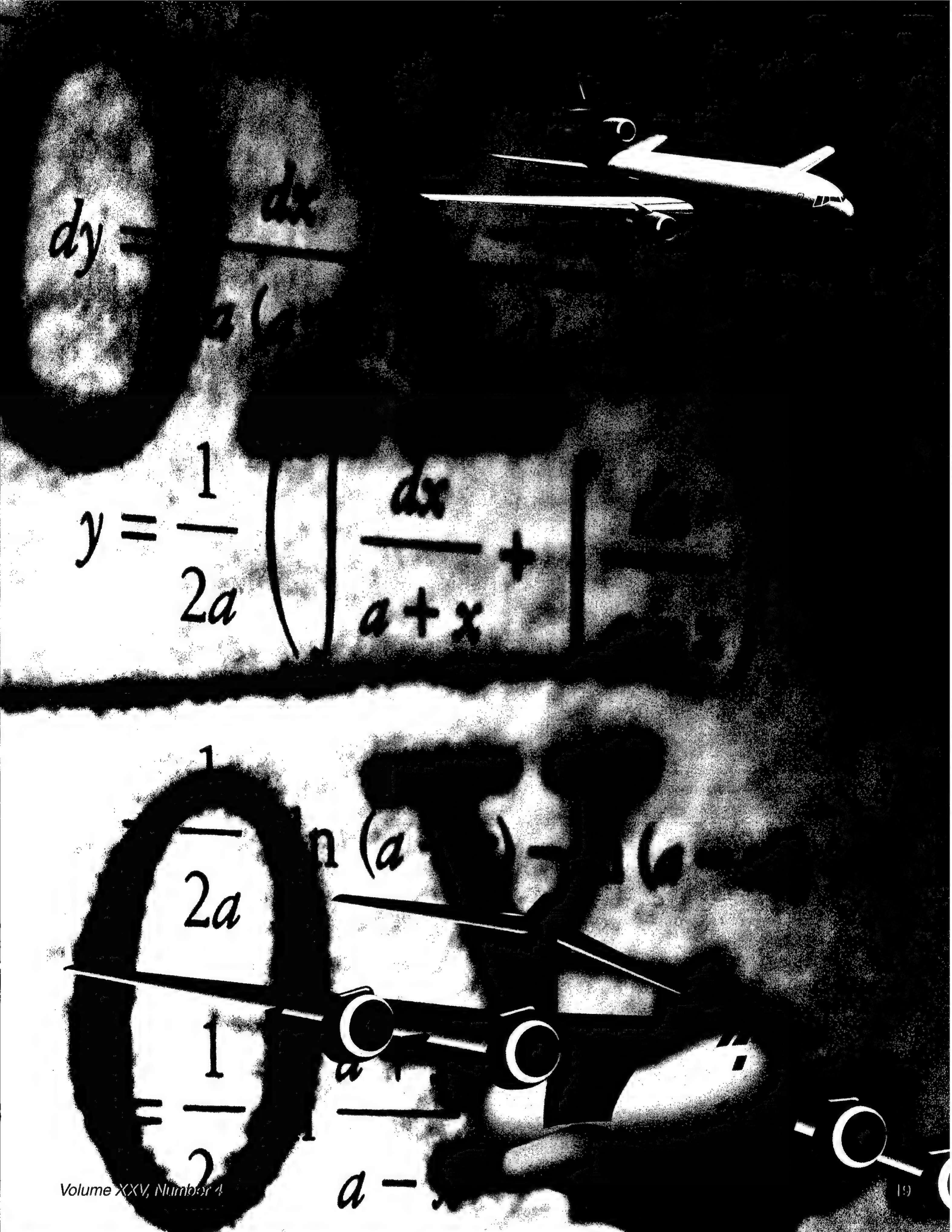
Currently, all AGE utilization is very low. Metered hours per cart pointed to an overabundance of AGE, possibly even an overabundance for surge situations, which is a worst-case scenario for flight-line operations and aircraft maintenance.

	Actual	Model	
Sorties Flown	2,185	2,209.0	(within 1.1%)
Flying Hours	7,360	7,379.6	(within 0.2%)
APG-70 LRU Pulls	224	226.6	(within 1.1%)
APG-70 CND	115+	118.7	(within 3%)

Table 1: Desert Storm (1/16-2/28 1990) vs Modeled Statistics[4]

	Actual	Model
Sorties Flown	1,040-1,120	1,111.2
Flying Hours	1,640	1,633.2
APG-70 LRU Pulls	105	105.1

Table 2: Luke AFB vs Modeled Statistics[5]



Methodology

General Approach

LCOM, a simulation model, with stochastic inputs from several sources, drove demand for SGNSC and determined capacity and utilization. Standard flight schedules determined the potential population of aircraft requiring SGNSC support. Work unit codes for each aircraft type were used to address variance in demand characteristics and differences in SGNSC utilization by airframe.

AGE Reliability

Sensitivity analysis was performed on the reliability of the SGNSC system. Between telephone interviews and correspondence with the San Antonio Air Logistics Center engineer, the mean time between failures (MTBF) for SGNSC, as a new system, was estimated to be about 500 hours. The mean time to repair (MTTR) was estimated to be 2 hours. SGNSC failures were modeled using an exponential distribution with a MTBF of 50, 100, and 500 hours. LCOM repair times were modeled using a lognormal distribution with a standard deviation of 29 percent of the mean.

Travel Time

First Lieutenant Jeff Havlicek raised the importance of addressing travel time in an AGE study and suggested the variability of travel times could have a statistically and practically significant effect on mission effectiveness.[8] He used two constant travel times of 15 and 45 minutes.[9]

To model travel times, a delivery delay was incorporated into the LCOM model. Travis AFB, California, tracks AGE delivery times, and according to the latest information available, 80 percent of AGE deliveries were within 10 minutes, and 99 percent of AGE deliveries were within 20 minutes. A minimum delivery time was unavailable as was the exact distribution. An assumption was made that 100 percent of the time maintenance would call for SGNSC support 10 minutes prior to actually needing the SGNSC. The travel time was modeled in LCOM with a notional minimum travel time of 5 minutes and another point at 10 minutes. Eighty percent of the delivery times were linearly interpolated between 5 and 10 minutes. The remaining 20 percent of the delivery times linearly were interpolated between 10 and 20 minutes, with the upper bound set at 20 minutes. AGE delivery drivers were assumed to be available when needed.

SGNSC Users

In terms of modeling users of the SGNSC resource, aircraft were the SGNSC users or calling population. Transient aircraft use very little nitrogen and could be adequately served with one primary SGNSC and one spare, for a total of two SGNSC. Transient aircraft typically experience temporary repairs or failures until they can get to home station for a permanent fix. Assuming transient aircraft can be adequately serviced with two SGNSC, one primary and one spare, this study excludes transient aircraft and concentrated on the demands of Travis' C-5 and KC-10 aircraft. This simplified the model and facilitated extensibility of the methodology to other bases, aircraft, and AGE. This methodology extensibility was a primary consideration for this research effort.

Aircraft preflight status was given a higher priority for nitrogen than all other tasks requiring nitrogen, allowing the preflight aircraft to preempt other tasks that require nitrogen, similar to what would happen during a *red streak* or short-notice, high-priority maintenance on a flight line if there were not enough resources to go around. If this happened on an actual flight line, the lower priority task would be preempted to service the flyer. The LCOM model accurately reflected this situation.[10]

Failure Data

G081 (Gee-oh-eighty-one) was the maintenance data-collection database for heavy aircraft and was key to the success of this effort. A page-by-page review of all applicable technical orders for each airframe was beyond the scope of this study. As a result, subject matter experts familiar with the airframe were interviewed to determine the work unit codes requiring SGNSC support. If the work unit code (WUC) required SGNSC support, WUCs were used and matched against SGNSC requirements. Data from G081 were gathered by aircraft type. One issue with G081 was the time necessary to complete the maintenance task. This includes all maintenance, not just the time necessary for nitrogen servicing. Only the total time is collected in the maintenance data system. For those WUCs, field interviews were used to determine appropriate nitrogen service times.

The WUC was the initial data flag. Each job included the WUC and time taken for the repair job. The time taken to complete the job determined the mean time for the job length. An assumption of unconstrained maintenance availability was necessary to focus on analysis of the changes to the SGNSC quantities. Data collected from G081 were the actual number of occasions that systems requiring nitrogen were serviced. Distributions were based on these maintenance intervals. It was assumed maintenance was available according to the same priority schedule and nitrogen would be required in a similar manner. This assumption may or may not hold in a wartime environment; however, it was necessary as data for wartime consumption were not available. Data were aggregated to the fleet for an overall distribution.

Failure data were extracted from G081 by WUC and aggregated to include the number of failures, MTTR, and the mean time to service, as nitrogen consumption is not necessarily required for the entire task time. This was an acceptable assumption, as it reflected reality on the flight line; technicians do not call for the nitrogen cart until they require it. A majority of the components that require nitrogen servicing are part of the aircraft landing gear system, and failures are more accurately reflected if defined by number of landings as opposed to the standard number of flying hours. Modifications to the database accommodated this failure pattern. Historical aircraft arrivals at Travis were compared to the number of failures recorded in G081 for the same period to arrive at the number of failures per number of landings. An exponential distribution was used to model the failure rates of these nitrogen systems. The failure rates, as determined by system, with task and service times are given in Tables 4 and 5. Basic postflight (BPO) and preflight (PRE) service intervals were interpreted through interviews with flight-line personnel, as BPO/PRE nitrogen servicing is often undocumented.

Output

The percentage and number of canceled missions are a more immediate, readily identifiable reflection of AGE availability on mission effectiveness than flight sortie effectiveness. If an aircraft mission is canceled, then there is a very real penalty for not having AGE available. All other resources were assumed to be

WUC	KC-10 System	Task Time-Hrs	Service Time	Landings/ Action
13DAB	MLG	2.75	0.35	8.82
13DBB	NLG	2.75	0.35	16.17
03200	BPO	4.67	0.88	2.00
03100	PRE	0.77		2.00
45ABH	Accumulator	0.87		200.00
13AAO	MLG strut	1.12		12.13
13BAO	NLG strut	1.12		12.13
13AEO	Centerline landing gear	1.12		19.40
46GJO	Boom pneumatic disconnect	1.25		7.46

Table 3: KC-10 Task/N_2 Service Times and Number of Landings per Action

WUC	C-5 System	Task Time-Hrs	Service Time-Hrs	Landings/ Action
3100	Preflight	0.77		2.00
3200	Throughflight	0.50		2.00
3210	BPO	2.00		2.00
13AAA	Shock Strut Assembly	2.8	0.75	16.44
13FCN	Ldg Gr Strg Actuator	2.70	0.75	411.00
13LA*	MLG Tire	2.00	0.35	.83
13LC*	NLG Tire	2.00	0.35	6.42
24ALP	APU Accumulator	3.95	0.88	206.00
91AAF	Slide bottles	1.35		206.00
11LCH	Crew Entry door accumulator	2.80	0.88	206.00
11LCK	Crew Entry-door accumulator	2.80	0.88	250.00

Table 4: C-5 Task/N_2 Service Times and Number of Landings per Action

unconstrained to isolate SGNSC and allow analysis of SGNSC effectiveness. Flight sortie effectiveness or mission capability is not as closely related to AGE availability. It is the author's opinion that mission capability can suffer some, but the cost of AGE is not comparable to the cost of a lost mission. As a result, the number or percentage of canceled missions was examined for statistical and practical significance.

Data on utilization of AGE were collected to give users an expectation of usage. The proposition of an overabundance of AGE was addressed examining utilization and AGE wait time. At issue was not necessarily utilization, although this gives the decision makers an idea of usage, but the ability of AGE to meet mission requirements was at issue. However, focus on utilization does not consider the impact of multiple requests. The capacity to handle periods of high demand was expected to be the main driver of AGE and a natural means for sizing an AGE force such as SGNSC.

Results

A variety of scenarios were defined to examine two factors of interest: SGNSC inventory levels and SGNSC reliability. AMC has projected 18 SGNSC units for Travis, the base of study. The transient aircraft mission at Travis required SGNSC; however, this mission was neither a focus of this study nor a significant user of local SGNSC. Two SGNSC were detailed to support the transient mission to account for this real concern. Three SGNSC inventory levels were examined: 5, 10, and 15. For each inventory level, a SGNSC MTBF of 50, 100, and 500 hours was modeled.

Travis AFB operations were modeled for a 5-year period. As aircraft complete missions, failures occur. Failures requiring SGNSC were modeled using peacetime and surge flying schedules.

Data collected from this 5-year simulation represented steady-state data. As with most steady-state simulations, the initial period of the simulation, called the transient or warmup period, was not indicative of steady-state conditions. Including transient data in steady-state calculations introduced bias. The transient period, conservatively determined to be the first 6 months of the simulated timeframe, was removed.[11] Final statistics were based on 30 replications, each with the initial transient removed. Scenarios were compared based on 95-percent confidence intervals. As noted in the results below, various confirmatory simulations were conducted as dictated by the initial analysis of the simulation data. The primary data examined were SGNSC utilization, mission effectiveness, and time spent waiting for SGNSC assets to become available.

Peacetime Results

Initial results were impressive. At an inventory of five SGNSC with a 50-hour MTBF, aircraft sorties did not suffer at all. A subsequent confirmatory run reducing the inventory to three still did not affect the flying schedule. SGNSC utilization was only 29 percent, which included travel time. LCOM limitations necessitated including travel time in the utilization rate. However, wait time increased dramatically, from an acceptable average 4.4 hours per month with five SGNSCs, to a likely unacceptable 69.2 hours per month with three SGNSCs. This confirmed nitrogen utilization was not very high.

People are the most valuable resource on the flight line, and if they are waiting for equipment, they cannot work. Greater coordination between the AGE shops and maintenance holds promise in leveling out demand by forecasting nitrogen requirements. The ability to plan AGE consumption is merely held out as an opportunity for future improvement, especially regarding deployments. The current demands for attention on maintenance forced this study to focus on the most efficient and effective utilization of AGE within existing command structures and maintenance concepts.

Therefore, the focus changed from one of aircraft ability to meet the schedule to one of reducing wait time to an acceptable level of pain. General goals in the service sector are an 80 percent utilization rate for resources. Some sectors cannot and probably should not try to attain this kind of utilization. A more appropriate comparison would be with emergency services. An emergency ambulance has a utilization of about 30 percent.[12] However, if someone must wait for an ambulance, the family may not be comforted knowing an ambulance fleet was reduced to increase overall utilization. The flight line presents a somewhat similar scenario; we do not want to wait for support equipment when trying to restore aircraft to a mission-capable status. The consequences of waiting for AGE on the flight line outweigh the advantages gained by higher utilization of AGE.

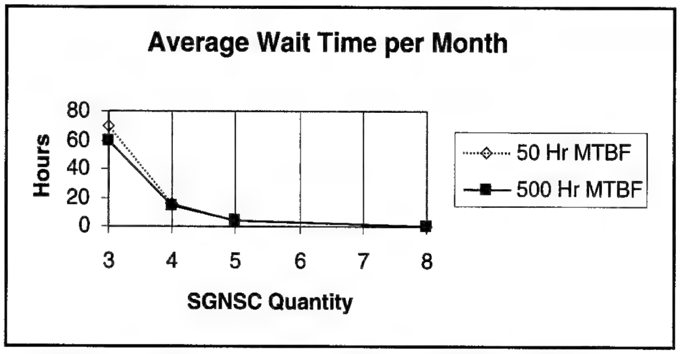


Figure 1: Comparison of Quantity and MTBF on Wait Time

SGNSC Unit Quantity	Average total wait (hrs/month) (hrs/month) ((hrs/month) ((hours)time/ month (hrs)	Utilization
3	59.6	28.9%
4	14.4	21.6%
5	4.4	17.9%
8	0	11.2%
10	0	9.0%
15	0	6.0%

Table 5: Effect of SGNSC Quantity on Wait Time and Utilization (Peacetime)

95% CI	3/50	3/500	4/50	4/500	5/50	5/500	8/50	8/500
Lower	68.25	58.83	15.15	14.13	4.40	4.32	0.07	0.07
Upper	69.89	60.23	15.84	14.59	4.66	4.61	0.10	0.09

Table 6: Difference in Wait Time at 50 and 500 Hour MTBF (Peacetime)

The failure rates of SGNSC were manipulated to determine the sensitivity of demand. MTBF times of 50, 100, and 500 hours were used. The differences were very small as illustrated in Figure 1.

SGNSC was not very sensitive to changes in reliability as Figure 1 shows. It was much more sensitive to the quantity of SGNSC. An additional run with an inventory of four was included in Figure 1. Wait times did not begin until an inventory dropped and a quantity of five SGNSCs was reached. Wait time increased very quickly after that, as Table 5 shows.

A comparison of confidence intervals by SGNSC MTBF in Table 6 shows that an inventory of five SGNSCs or more resulted in no statistical difference in wait time with 95 percent confidence. Even when there was a statistical difference, the practical differences were minor until SGNSC was constrained to three units.

Surge Results

While the peacetime results were illuminating, they did not address the ability to meet maximum demand. The military, by nature, requires excess capacity. The ability to respond quickly and with force during wartime is necessary. An unfortunate side effect of this capability is the apparent lack of utilization of capacity during a peacetime posture. Using an LCOM surge template, the model was shifted into a fly-when-ready mode. SGNSC quantities of 5, 10, and 15 were used again to examine sensitivities. Additional confirmatory runs with quantities of 11 and 12 SGNSC were added to further clarify wait times and utilization. MTBF times were initially 500 hours, but additional runs with 50-hour MTBF times were conducted to verify SGNSC availability under maximum-usage scenarios at quantities of 11 and 12. The results of the comparison of 50- and 500-hour MTBF times under a surge scenario were very similar to the peacetime results. While Table 7 shows statistical differences at a 95-percent confidence, the practical differences are again minor at these inventory levels.

The effect of varying reliability of the SGNSC carts was minor compared to varying the quantity of SGNSC. The wait time *knee in the curve* occurred when SGNSC inventory fell to 12 carts. Reduced further to 11 and then 10 units, wait times increased dramatically. An inventory of five SGNSCs gave an impressive 94-percent utilization. However, just as we do not want to wait for an ambulance, we cannot accept the waiting time associated with this tremendous utilization. Utilization and wait times for the various quantities of SGNSC are listed in Table 8.

The effect of changing to a fly-when-ready mode of operation exposed SGNSC to a much higher demand rate. What was apparently a vastly underutilized fleet of ten units with a dismal peacetime utilization of 9 percent exploded during surge to 51 percent, with an unacceptably low, overall average wait time of 22 hours per month.

(Continued on page 40)

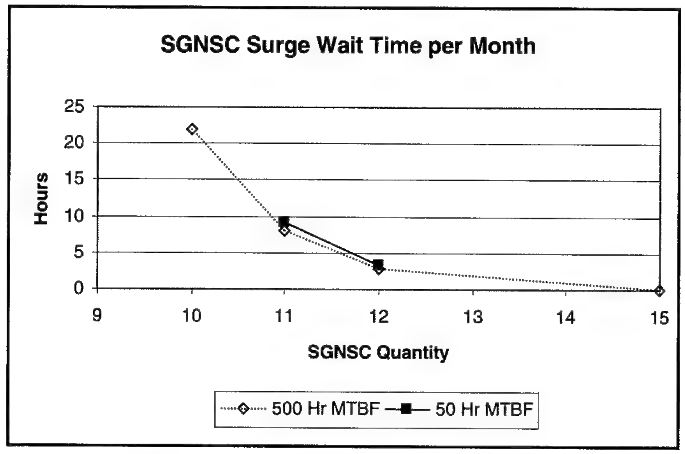


Figure 2: Comparison of MTBF times and Quantity on Wait Times (Surge)

95% CI	11/50	11/500	12/50	12/500
Lower	8.80	7.88	2.96	2.73
Upper	9.25	8.20	3.18	2.90

Table 7: Difference in wait time at 50- and 500-Hour MTBF (Surge)

SGNSC Quantity	Average Wait Time Per Month (Hrs)	Utilization
5	2,860.0	94%
10	22.0	51%
11	8.0	46%
12	2.8	42%
15	0	34%

Table 8: Effect of SGNSC Quantity on Wait Time and Utilization (Surge)

Logistics Today

Supply and Maintenance Focus

Defense Working Capital Fund

JUNE TAYLOR

In the simplest of terms, the DWCF was established to allow the federal government purchase and repair activities to account for costs and revenue as if it were a commercial business.

The commercial sector of the American economy has long used the management accounting principle of transfer pricing—the price charged when one segment of a company provides goods or services to another segment of the company.[1] This cost exchange allows an activity to quantify its value-added to the company even though it may not sell any products to an outside customer. In addition, the transfer price allows accounting for the true price to a company of a product or service.[2] Commercial companies also use transfer prices in developing their make-or-buy decisions when faced with the choice of using an internal company product or service or contracting outside the company for the same product or service.[3]

The government continues to look for ways to emulate commercial best practices, as is evident in acquisition regulations and product support policies, that have blossomed during the last decade.[4] A consistent criticism is the government really does not know how much it costs to organically support weapon systems or how much it pays for products and services.[5] The Defense Working Capital Fund (DWCF) was established to help the government account for costs and budget outlays.

The purpose of this article is to suggest improvements in the way DWCF maintenance and supply funds are used. The primary research question discussed is, what are the DWCF policies that need to be revised to ensure the fund's use is the most efficient and effective possible? The follow-on question to this is, how should these policies be revised? As the Department of Defense (DoD) changes processes to become more of a fee-for-service department, the use of the DWCF is becoming increasingly prevalent. For individuals who have not worked with this before, it can be very confusing. By taking time to objectively review policies for potential improvements, the use of the fund may become a favored approach rather than one to be shunned or bypassed. The intent of this article is to share lessons learned and potential streamlining suggestions that could be implemented at DoD and Service levels.

Background

Origin

In the simplest of terms, the DWCF was established to allow the federal government purchase and repair activities to account for costs and revenue as if they were commercial businesses. The Defense Business Operations Fund (DBOF) was a DoD-wide revolving fund established in 1991 by consolidating the Services and Defense Logistics Agency (DLA) stock and industrial revolving funds. The Under Secretary of Defense (Comptroller) returned primary responsibility for these funds to the parent Service or component, and the DBOF concept became the DWCF.[6] The DWCF was established under the authority of Title 10, United States Code (USC) Section 2208, and was effective in fiscal year (FY) 1992.[7] It was established to provide a funding mechanism for the DoD corporate structures to absorb risk in planning investment programs for maintenance and supply. The intent was to allow DoD organic maintenance and supply activities to make investments in the near term and recoup the costs through future year pricing structure. The following discussions focus on the workings of the DWCF and its subordinate Air Force Working Capital Fund (AFWCF).

Definition

The DWCF is a reimbursable operations fund that sells support goods and services to DoD and other users. The Air Force accomplishes these sales through its activity groups at prices necessary to recover material and operating expenses.[8] These revolving funds are financial systems dependent on the sale of goods and services for the cash necessary to finance activities undertaken by stock funds (purchase goods for resale) and industrial funds (primarily government-operated maintenance and production activities).[9] In the long run, revolving funds are to be a zero-profit activity for the government—the payment for goods and services by the buying activities exactly equals the associated costs. A primary difference between DoD revolving funds and the way a commercial service, maintenance, or production concern works is the commercial firm expects to make a profit.

DWCF Users

DWCF customers, and hence the AFWCF by definition, include any DoD command, organization, office, or other element; non-DoD federal government agencies; private parties and concerns when authorized by law—this includes foreign governments, state and local governments, and others not officially representing the federal government—and those manufacturers or developers authorized use of DWCF based on law.[10]

Fund Objectives

The DWCF was designed to accomplish the following objectives:[11]

- Provide a more effective means for controlling the costs of goods and services required to be produced or furnished by government activities and a more effective and flexible means for financing, budgeting, and accounting for the associated costs.
- Create and recognize contractual relationships between DWCF activities and those activities that budget for and order the end products and services.
- Provide managers of DWCF activities the financial authority and flexibility required to procure and use manpower, materials, and other resources effectively.
- Encourage more cross servicing among DoD components and their operating agencies with the aim of obtaining more economical use of facilities.
- Facilitate budgeting and reporting the costs of end products. This will underline the cost consequences of choosing between alternatives.

In addition, the AFWCF uses revolving accounts for the following:[12]

- Sell support goods and services to the Air Force, DoD, and other users through its activity groups
- Allow operating activities (customers) to purchase support from activity groups (providers) at prices that recover AFWCF material and operating expenses.
- Provide cost visibility and accountability to encourage activity groups to provide quality products and services at the lowest cost and provide decision makers the information required for effective resource management.
- Allow customers to develop their own support requirements and use funds from their operations and maintenance (O&M) budgets to pay AFWCF providers for such support as depot maintenance and spares. Depot-level maintenance services may be purchased from contractor, organic (government), and interservice sources of repair.[13]
- Allow the Air Force to track its reimbursable activities under activity groups: Information Services, Supply Management Activity Group (SMAG), Depot Maintenance Activity Group (DMAG), and the transportation used by the US Transportation Command.

Policy Review

Research and Analysis Process

As each SMAG and DMAG problematic policy is described in the policies section, its source is identified, alternatives are

described and evaluated based on criteria listed following this paragraph, and the recommended alternative and rationale for selection are described. An evaluation matrix is shown after each alternative set (in all cases, zero points will be assessed if a criterion is not applicable).

A. Impact to other parts of the DWCF/AFWCF

1—Impacts two or more other activity groups.
3—Impacts one other activity group.
5—Impacts no other activity group.

B. Impact to the number of depot-level process steps

1—Increases process steps.
3—Reduces steps less than 10 percent.
5—Reduces steps greater than 10 percent.

C. Impact to warfighter total net costs for maintenance and supply activities

1—Increases total net costs without offsetting benefits.
3—Total net costs remain stable with or without offsetting benefits.
5—Decreases total net costs with offsetting benefits.

D. Implementation Difficulty

1—Many process owners with vested interests to keep processes as they are; congressional action (statute changes) required.
3—Several process owners with vested interests; regulatory waivers required.
5—Several process owners with vested interests; no legal changes or waivers required.

E. Implementation Success Risk

1—High risk.
3—Medium risk.
5—Low risk

F. Correlation to Best Commercial Practices

1—Low correlation.
3—Medium correlation.
5—High correlation.

G. Impact to budget execution capability

1—Extensive—negative.
3—Limited.
5—Extensive—positive.

Problematic Policies

Title 10 USC, Section 2208, was very specific in its intent: allow the DWCF to function as a self-sustaining activity so the government can perform as a commercial business. Process execution to meet legal and regulatory requirements in one part of the fund has sometimes inadvertently (or on purpose) caused a hardship for other parts of the fund. A few examples affecting SMAG and DMAG are described in the following paragraphs. These problematic policies were identified during discussions at SMAG and DMAG reviews, interviews with key management members who work with the fund daily, personal experience, and other sources noted by reference. If not annotated otherwise, the alternatives listed are as a result of interviews, e-mail exchanges, and lessons learned from various college and government courses and meeting discussions.

A. Point of Sale

Currently, DoD regulations do not allow the depot to record the sale of an item until it is actually taken off the shelf for use by a buying customer (field or depot level).[14] The customer places an order to fill a *hole* in the stock level. Once the order is received, it is placed in the customer's stock room. The payment to the DWCF from the warfighter's O&M funds does not occur until the item is actually issued for use.[15] This means the selling agency may not receive credit for a sale until well after it has been delivered. Following this process is especially harmful to the DWCF if the item is a high-cost, insurance item that may or may not ever be issued. The DWCF cannot recoup the costs to procure, repair, and process this item unless it raises overhead prices for the next year or unless it can sell it directly to another buyer by forcing a lateral move from one using organization to another. The user incurs holding costs for the inventory *just in case* requirements; however, no penalty is incurred. The warfighters have also been known to take advantage of this *float* time to use their O&M funds for other purchases that may or may not be from the DWCF.

	Other Parts of the DWCF	Number of Depot-Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
A1. Point of sale withdrawn from supply	3	0	0	0	0	1	1	5
A2. Point of sale upon requisition	3	5	4	3	1	5	5	26
A3. Point of sale upon delivery	3	5	4	3	4	3	4	26
A4. Point of sale prior to shipment	3	5	4	3	3	5	4	27

Table 1. Point of Sale

- **Alternative A1.** No change—point of sale is when the item is withdrawn from supply.
- **Alternative A2.** Change the point of sale to when the item is requisitioned.
- **Alternative A3.** Change the point of sale to when the item is delivered.
- **Alternative A4.** Change the point of sale to prior to shipment.

Alternative A4 seems most viable. The SMAG can pay the repair or purchase of the item as part of its normal revolving fund process. A commercial catalog business would not normally allow an item to be purchased without knowing how or when it is going to be paid for: the revolving fund should emulate the commercial entity, the funds used by the DWCF can now be used to repair or purchase additional requirements, and credit can be taken for the purchase. The item is ready for customer use: there is only delivery time between the time the warfighter pays for the item and when it is received for use or stockage, and the customer will be forced to scrutinize what is ordered and why. The negative impact on the warfighter is the funds that could be used for other purchases are now paying for spare parts that may or may not be used right away.

B. Engineering Investment

The use of the DWCF to develop engineering solutions to parts obsolescence and system upgrades is accomplished under very specific guidance. These funds can be used to support operationally used engineering efforts that do not change an item's form, fit, or function. For example, an item is nearing the end of its life cycle. AFWCF dollars may be used to do reverse engineering on the item to improve supportability or competition (for example, develop a build-to schematic or drawing) or improve the reliability or maintainability of an item itself. However, if a modification results from this reverse engineering, other types of funds need to be used to complete the modification development and test, purchase, and application.[16] What this does to the project manager is force budget lead-time-away planning (approximately 3 years) in order to bring all the funds together in the required years to make the change happen. In the meantime, item supportability may be degraded, weapon systems may be grounded, or the customer may go elsewhere for support, thus denying funds to the DWCF. Further, warfighters may be subjected to safety risks if configuration and quality control are not considered.

- **Alternative B1.** No change—following regulatory guidance.
- **Alternative B2.** Allow an engineering funds line, with associated multiple types of funds included in each budget cycle.
- **Alternative B3.** Allow the DWCF to pay for all parts of the upgrade of an operationally used item.
- **Alternative B4.** Move all engineering requirements into other O&M funds accounts.

Alternative B3 would provide the most benefit to the government, engineer, and warfighter. The manager would be able to fully plan an upgrade to an operational system without worrying about misuse of funds or wondering if all the funding needed to complete a project will be available when the schedule dictates. Rules would still need to be in place to preclude building a new weapon system using a small part of an existing system. A small enhancement to the alternative would be to allow a budget *wedge* to be included each year to take care of *unknowns* that may pop up during a budget execution year.

C. Overlapping Price Impacts

As noted, there are several activity groups within the AFWCF that are reimbursed separately. Having different activity groups to support depot maintenance and supply management leads to a spiral in rate changes. As DMAG is adjusted, it offsets SMAG, and that, in turn, changes DMAG rates.[17]

- **Alternative C1.** No change—continue to develop prices without regard to impact to rest of the fund.
- **Alternative C2.** Combine the SMAG and DMAG into one activity group.
- **Alternative C3.** Allow the SMAG and DMAG to be subdivided into work centers and track costs through and across the work centers.
- **Alternative C4.** Change the breakout in the DMAG and SMAG from activity groups to work centers and track costs for an entire work center.

Alternative C4 would most emulate a commercial entity in terms of being able to identify costs to the end product or service.[18] Once operating in a work center mode, budgeting for requirements will be easier because costs for processes and resources are known and can be consistently applied. Work

	Other Parts of the DWCF	Number of Depot-Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
B1. Follow regulatory guidance	3	0	1	0	3	1	1	9
B2. Engineering funds budget wedge	3	6	5	3	3	5	4	29
B3. Allow DWCF to pay for all upgrade needs	3	5	5	3	5	5	5	31
B4. Move engineering reqmts to other O&M budget accounts	3	5	2	1	1	4	1	17

Table 2. Engineering Investment

	Other Parts of the DWCF	Number of Depot Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
C1. Develop prices best for Individual sub-funds	3	0	1	0	0	1	1	6
C2. Combine SMAG and DMAG	3	5	3	3	3	3	5	25
C3. SMAG and DMAG divided into work centers and track actual costs for each	3	1	2	3	3	3	4	19
C4. Eliminate AGs, create work Centers, track costs for each work center	3	5	3	3	4	5	5	28

Table 3. Overlapping Price Impacts

	Other Parts of the DWCF	Number of Depot-Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
D1. Recoup losses in year of execution	3	0	1	0	0	1	1	6
D2. New PBD that allows for specific infrastructure-related recoupment	3	1	2	1	3	4	4	18
D3. Rescind PBD 437; revert to original Title 10, USC 2208	3	5	2	1	3	4	4	22
D4. Develop process that allows for realistic rate setting	3	5	4	1	4	5	5	27
D5. Fund DWCF activities through normal O&M accounts	3	1	1	1	1	0	1	8

Table 4. PBD 437

standards can be updated to reflect actual rather than engineered baselines.

D. Presidential Budget Directive (PBD 437)

When Title 10, USC 2208 was written, the intent was for the depots to be able to make infrastructure investments needed to keep an efficient, effective activity in place without having to worry about immediately recouping the funds. However, budget cuts over the years and Service activities resulted in a large bill to be recouped. In response, the Office of the Secretary of Defense instituted PBD 437 to put pressure on the Services to contain losses. PBD 437 did this by forcing losses after FY98 to be addressed in the year of execution as opposed to the original law's intent to accomplish the DWCF rate build to recover prior year losses.[19] Surcharges are not calculated on particular workloads for a customer but are based on all DWCF losses even if the loss incurred is a future capability, infrastructure investment. The centers must recover all costs.[20] It needs to be noted that DWCF budgets are established using engineered standards or other established baselines while PBD 437 requires reimbursement against the actual costs incurred. This is in direct conflict with guidance provided in the commercial sector when dealing with transfer prices between internal organization activities. The established policy is to use standard or budgeted costs as the baseline for determining the transfer price and associated calculations.[21]

- **Alternative D1.** No change—continue to recoup losses in the year of execution per PBD 437.
- **Alternative D2.** Replace PBD 437 with a new PBD that allows for specific infrastructure-related recoupment in future years and require same-year recoupment of only losses incurred due to managerial mismanagement.
- **Alternative D3.** Totally rescind PBD 437 and revert to the original Title 10, USC 2208.
- **Alternative D4.** Develop a process to allow depot maintenance to do a better job of setting rates to recover all costs, emphasizing realistic productivity.

- **Alternative D5.** Rescind PBD 437 and Title 10, USC 2208 by funding all depot maintenance and supply chain management activities through the normal O&M funds account.

Alternative D4 will allow the DWCF to establish the most realistic budget possible. By working closely with the warfighter during budget development, discussion can take place to identify the realistic spares needs based on usage, induction rate into aircraft depot repairs, and reduction of depot carry-overs from one year to the next, just to name a few.[22] The more realistic the assumptions are that go into budget development, the easier it will be for both the warfighter and organic depot maintenance and supply managers to use the funds received during the budget execution year. The end result should be that PBD 437 has less harmful effect than is currently being experienced with ever-changing execution-year rates and charges.

E. TSPR Contracts

A Total System Performance Responsibility (TSPR)-type contract is one in which a commercial contractor is given the responsibility to accomplish depot-level maintenance and supply chain management activities using a contractor logistics support arrangement. This practice is encouraged through various acquisition reform initiatives and DoD-level guidance.[23] The funds used in TSPR-type contracts are not contained within the DWCF. TSPR-type contracts can be useful in certain circumstances. The difference between a contractor and Air Force Materiel Command (AFMC) financial reporting, however, stems from the basic fact that a contractor is able to account for its costs to a specific system level. AFMC balances costs over a whole host of product lines and aircraft to recover costs. The government cost accounting system is not configured to allow a single product manager to focus solely on the costs associated with a system.[24] In cases where supply management or depot maintenance work has been removed from the DWCF, the remaining DWCF users pay a larger amount of overhead because there are fewer tasks and items over which the overhead is spread.

- **Alternative E1.** No change—continue to encourage use of TSPR-type contracts.
- **Alternative E2.** Discourage use of TSPR-type contracts.
- **Alternative E3.** Neither encourages or discourages using TSPR-type contracts but includes the contractor funds for DWCF-type activities in the DWCF.
- **Alternative E4.** Change all DWCF to normal O&M funds categories.
- **Alternative E5.** Develop information technology solutions to account for the government costs associated with production, financial management, and so forth to the weapons system level.[25]

Alternative E5 is the most reasonable way to truly identify costs to the weapons system level and allow for real-time data to be used in decision making. While challenging to implement, starting from scratch to build an interactive data warehouse will allow real-time data to be automatically input to the system to ensure decisions are made using the most current information. Having government cost data readily available should also provide a much better data source to make the decisions, whether a TSPR-type, organic-only, or partnership or combined effort is the most cost effective to the warfighter and taxpayer. Having a decision support system readily available will also emulate the way a commercial business operates.[26]

F. Pricing Stability and Budget Development

One of the key tenets for using the DWCF is to "establish, whenever feasible, standard prices or stabilized rates and unit prices for goods and services furnished by DWCF activities, thus enabling ordering agencies to plan and budget more confidently."[27] What has actually happened, however, is the customer does not know purchase or repair prices and rates until

	Other Parts of the DWCF	Number of Depot-Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
E1. Encourage use of TSPR-type contracts	1	0	2	2	4	4	4	17
E2. Discourage use of TSPR-type contracts	1	0	3	2	3	2	4	15
E3. Include contractor funds for DWCF activities into the DWCF	1	1	5	1	1	3	5	17
E4. Change all DWCF to normal O&M accounts	1	0	2	1	1	3	2	10
E5. Develop current IT tracking and control systems for finance and production	1	1	5	4	4	5	5	25

Table 5. TSPR Contracts

	Other Parts of the DWCF	Number of Depot Level-Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
F1. Develop budgets 2 years in advance with minimal adjustments	3	0	1	3	3	1	1	12
F2. Establish realistic requirements and rates budget lead time away; minor adjusts interim	3	1	3	3	3	3	3	19
F3. Change budget rates only by inflation factors in execution year	3	0	3	3	4	4	3	20
F4. Develop budgets using prior DMAG/SMAG actuals; update through execution year; adjust all budgets to match original planning program	3	0	4	4	3	4	4	22
F5. Directly reimburse AFWCF from Air Force O&M accounts; issue and provide free services to warfighter	1	1	4	1	3	1	3	14

Table 6. Pricing Stability and Budget Development

the funds execution year. When a price fluctuates to any extent, it impacts how much repair or purchase a customer can make. Budgets for the AFWCF depot maintenance and supply management activity group rates are developed 2 years in advance of budget execution using 2-year historical data to forecast future requirements. The direction provided by higher headquarters has been to use specific inflation, fuels, utilities, and material price rates, peacetime operating hours, normal depot and organizational level maintenance factors, engineered maintenance standards, and peacetime repair and acquisition rates. The plan is to have a net operating result of zero profit. The rates are adjusted somewhat in the year prior to execution but not by much, usually. In the year of execution, another factor may be added to cover other overhead factors. At the same time, PBD 437 requires all losses incurred in the year of execution to be recovered during that year. If any of the factors provided by direction are lower than actual costs, the AFWCF will show a deficit required by law to be recouped during the year of execution. This policy affects not only the AFWCF but also the warfighter who is allocated O&M budgets based on the AFWCF budgets.

- **Alternative F1.** No change—continue to develop budgets 2 years in advance and make minimal adjustments thereafter.
- **Alternative F2.** Budget lead time away, the customer and depots work together to establish the real requirement and real prices and rates that will need to be charged and then make only minor adjustments in the interim and funds execution years.
- **Alternative F3.** Once the prices are set in the interim year, only inflation factor additives would be allowed in the execution year.
- **Alternative F4.** Develop budgets using DMAG and SMAG actual rates from the year prior to budget development year, update rates the year prior to and in execution year based on actuals the years prior, and adjust associated using command O&M accounts to be able to purchase the same amount of goods and services as planned during the initial budget planning year.
- **Alternative F5.** Directly reimburse the AFWCF from O&M accounts at Air Staff during execution year, issue spares, and provide repairs and depot maintenance at no cost to the warfighter.

Alternative F4 is the best choice. Actuals are used to develop the budget forecasts, the rates are updated in the interim and execution years to identify added materials/fuels/utilities/ inflation costs that may have occurred, and the final funds allocations will be adjusted to ensure the warfighter is able to purchase or have repaired to the same level as budgeted for 2 years prior. This provides stability and realism to the budget process.

G. Legacy Information Systems

Legacy information management systems are late 1960s and 1970s technology, with very few upgrades accomplished along with technology growth.[28] Currently, more than 70 disparate functional information systems may have to be accessed to obtain information for a single report. Various groups within the AFWCF use the functional information systems: financial, depot maintenance, supply chain, and program management. The metrics-gathering process and reporting provide 2-month-old data for senior decision makers to evaluate. Depot maintenance and supply chain managers continue to look for ways to work with the information they have through use of wrapper technology; however, the available data are still old.

	Other Parts of the DWCF	Number of Depot-Level Process Steps	Warfighter Total Net Costs	Implementation Difficulty	Implementation Risk	Best Commercial Practice Correlation	Budget Execution Capability	Totals
G1. Use wrapper technology to obtain metrics data from legacy systems	0	0	2	2	3	1	1	9
G2. Use legacy systems; develop data warehouse to feed data real-time	0	0	4	2	3	2	1	12
G3. Upgrade legacy systems to current hardware and software	0	0	2	2	3	2	1	10
G4. Eliminate legacy systems and install state-of-the-art data management system	0	5	4	2	2	5	5	23

Table 7. Legacy Information Systems

- **Alternative G1.** No change—continue to use wrapper technology to evaluate 2-month old data.
- **Alternative G2.** Keep the various legacy functional information systems and develop a data warehouse system where data is fed real time as updates occur.
- **Alternative G3.** Keep the different information systems intact and upgrade the hardware and software to current commercial standards.
- **Alternative G4.** Eliminate all legacy systems and install a state-of-the-art data-management system.

Alternative G4 provides the best opportunity to obtain the most current information as it occurs. As discussed in the TSPR section, until the government can track real-time information, the decisions will always have a faulty assumption base. Commercial entities ensure their information technology departments are able to keep up with the most current decision support-system technology in order for the parent business to remain competitive.[29] However, moving to an integrated data-warehouse scenario sounds much easier than the implementation would actually be. The up-front investment cost is high, but the payoff in being able to make decisions based on current data should occur very quickly.

Summary

Problematic policies impact the DWCF in negative ways. Use of newer information technology capabilities, in addition to complete coordination and communication with the warfighter customer, will go a long way in improving the process.

If any of the initiatives noted were to be implemented, there is a real opportunity to revitalize the DWCF by obtaining better control of the depot and supply budgeting and management processes. The end result will be better support to the warfighter.

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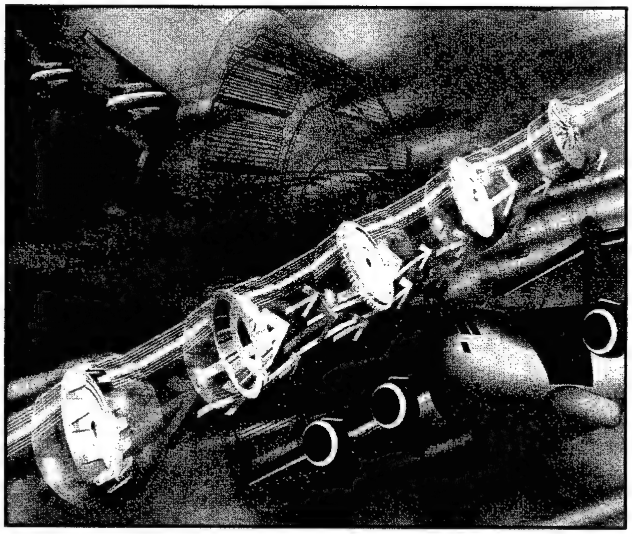
Karen L. Rukin

Air Force Spares Campaign

The Air Force's ability to execute its mission is directly related to the availability of weapon-system spare parts. The Air Force possesses the most advanced forces in the world, but under-funding and a decline in supply support have led to a significant drop in readiness. To rectify this potential hazard, the Air Force is in the process of implementing a major redesign of the spares supply process through a set of initiatives designed to improve support to the warfighter. These initiatives, known as the Spares Campaign, promise a fundamental reshaping of the internal management processes and data systems used on a daily basis to buy, repair, and distribute the thousands of different items needed to maintain weapon systems in a mission-capable (MC) status. This effort is being spearheaded by Brigadier General. Robert E. Mansfield, Jr, Director of the Office of Supply Chain Integration and Logistics Transformation and an implementation team, consisting of civilian and career military personnel with logistical and supply expertise and defense contractors with experience in supply chain management.



The Spares Campaign initiatives are the result of 4 months of intensive review and analysis by five teams representing expertise from every level of the major commands (MAJCOM), Air Staff, air logistics centers, Defense Logistics Agency, and commercial technical experts and consultants, including RAND and KPMG Consulting. Focus was on increasing weapon system availability and MC sorties and ensuring spares support in the expeditionary aerospace force (EAF) operating environment. The teams analyzed the strategic processes to identify disconnects, deficiencies, and areas for improvement:

- Forty-seven process disconnects were identified and then organized into 12 major categories
- One hundred and ninety implementation options were developed and considered to fix these disconnects; ultimately, 86 were deemed viable and considered for implementation.
- These implementation options were aggregated into 20 initiatives. A *red team* made up of eight senior Air Force logisticians reviewed the work done by the five teams.
- These 20 initiatives were then presented to the MAJCOM logistics commanders, who provided comments and ranked the initiatives.

Given the MAJCOM logistics commanders' priorities, the impact of the initiatives, and the time needed to implement them, General Mansfield selected eight initiatives for immediate action. These eight initiatives provide for a full spares process-improvement campaign.

The eight initiatives are:

- Restructure defense logistics requirements by setting stable prices and allocating costs to the responsible commands.
- Improve spares budgeting by establishing a single consolidated budgeting process for spares and consumable items, thereby meeting all spares requirements.
- Improve financial management by tracking execution of weapon-system support against approved requirements and budget. Simply put, determine whether the Air Force is getting a MC rate equivalent to the amount it is spending.
- Improve item demand and repair workload forecasting. This initiative calls for improved methods for calculating the type and timeframe of maintenance needs for the future; that is, commercial technologies like advanced planning and scheduling systems.
- Establish a virtual single inventory control point to centrally prioritize spares and funds allocation, passing the execution phase down to the air logistics centers.
- Align supply chain management to focus more on weapon systems and MC rate goals.
- Standardize and expand the role of regional supply squadrons to support expeditionary operations.
- Adopt improved purchasing and supply management practices, thereby reducing purchasing costs and improving product quality and delivery.

Any one of these initiatives taken by itself will not make a tremendous impact. But together, these initiatives will overhaul the entire spares process by getting spares into the hands of the maintainers and enabling the Air Force to improve weapon system support to meet current and future expeditionary requirements.

The implementation of these eight initiatives is the cornerstone in reshaping Air Force supply in the context of the EAF and readying the sustainment of them in the field.

For more information on the eight initiatives, upcoming events, and the latest implementation milestones, please log onto the Spares Campaign website, www.il.hq.af.mil/il-i.

The Air Force is in the process of implementing a major redesign of the spares supply process through a set of initiatives designed to improve support to the warfighter.

Air Force Research Laboratory

Mark M. Hoffman

The Air Force Research Laboratory, Deployment and Sustainment Division (AFRL/HES) conducts research and development to improve Air Force agile combat support capabilities and protect Air Force personnel in potentially toxic environments at deployed locations. Applications cover a broad spectrum of field, depot, and C2 operations with customers throughout the Air Force, Department of Defense, other government agencies, academic institutions, and industry. The following are ongoing research projects current as of January 2002. To obtain more information about these projects, contact the program managers listed below each project description.

Logistics Control and Information Support

Objective. To provide logistics personnel at all echelons within the wing easy-to-use, real-time, and highly accurate logistics and operations information needed for decision making.

Approach. The Logistics Control and Information Support (LOCIS) program is researching and developing technologies for an enhanced command and control capability for wing-level logistics personnel. LOCIS will provide easy access to logistics information to support *proactive* problem identification and resolution. LOCIS technologies will automatically collect and synthesize information required for key logistics decisions. In synthesizing the information, LOCIS is researching new ways to present information *at a glance* by using colors, aircraft profiles, and location of information on the screen. The most important pieces of information will be retrieved from existing maintenance, supply, munitions, and fuels information systems. Using advanced information technologies, LOCIS will automatically supplement this information with data from legacy information systems to provide immediate, useful information to logistics decision makers. In addition, LOCIS will use automated data-collection technologies to supplement existing data with real-time data. LOCIS will also provide logistics decision makers with a look-ahead simulation capability to identify problems in the planning and replanning process. As LOCIS technologies are developed and enhanced, they are being inserted into a *living laboratory environment* at the Air Force Special Operations Command for hands-on evaluation and testing.

Expected Payoff. LOCIS will provide logistics personnel the information and tools needed to better perform their duties. Through the use of real time, accurate information, and the application of advanced decision aids and presentation techniques, logistics personnel will be more effective in the day-to-day use of their assets and in short-notice deployment operations. **(Chris Curtis, AFRL/HESR, DSN 785-6718, Comm 937-255-6718, chris.curtis@wpafb.af.mil).**

Predictive Failures and Advanced Diagnostics

Objective. To reduce aircraft down time by enhancing the capability of maintainers to identify the causes of system failures through better diagnostics and, where possible, identify imminent system failures (failure prognostics) so repairs can be made more quickly.

Approach. Research the various areas that make up the diagnostics and prognostics process and focus on the improvements that offer the best return on investment. Initial efforts will involve an analysis of the diagnostics process, identification of those variables presently used to diagnose faults, identification of other variables for which data may be available (such as built-in test sensor data), and identification of historical information (such as failure rates and component failure histories for specific aircraft and components and for fleet aircraft and components). These data sources will then be used to develop advanced diagnostic algorithms. The algorithms will employ state-of-the art pattern recognition techniques; data-mining applications; intelligent agents; and self-adapting, artificial intelligence techniques. Based on work in the diagnostics area, aircraft prognostic techniques, to include an evaluation of generic component degradation measurements, will be investigated. A complete predictive failures and advanced diagnostics (PFAD) system will be defined in a concept of operations and system architecture report, and a subset of the PFAD tool suite will be developed and tested.

Expected Payoff. The new diagnostics capability will significantly increase the accuracy with which technicians are able to diagnose the causes of system failures, thereby restoring aircraft to operational status sooner and reducing the consumption of spare parts. Prognostics capability will make it possible to replace about-to-fail parts before they fail, reducing system failures, in-flight aborts, and aircraft accidents. **(Capt Ken Eizenga, AFRL/HESR, DSN 785-3771, Comm 937-255-3771, ken.eizenga@wpafb.af.mil)**

MDD and ACCD for Aircraft Maintenance

Objective. Assess promising new monocular display and alternative computer-input technologies for the presentation and retrieval of maintenance technical information for flight-line and depot maintenance.

Approach. A series of experimental studies is being conducted to evaluate the devices for supporting various maintenance tasks. Initial efforts focused on evaluating monocular display devices (MDD) and alternative computer control devices (ACCD) in a variety of environments. Current efforts are focused on testing a variety of newly developed MDD and ACCD technologies. MDD devices include occluding and see-through displays. ACCDs include state-of-the-art, speech-

based controls and electromyographic (EMG) controls. EMG devices use electrical signals accompanying muscle contractions to input user commands. Seven studies and numerous usability evaluations have demonstrated significant improvements in performance of technicians using MDDs under a variety of conditions and for a variety of tasks. Initial ACCD studies using speech recognition technology have shown significant benefits but also have identified problems due to noise. Studies are planned for using advanced speech recognition and special microphones placed in the ear. This work is being conducted as a joint effort with the AFRL Crew Systems Interface Division. In addition to MDDs and ACCDs, the Air Force Directorate of Maintenance is sponsoring studies to evaluate the use of other mobile computing devices on the flight line.

Expected Payoff. The payoffs to the Air Force will include improved maintenance performance, reduced maintenance down time, and reduced maintenance costs. **(Barbara Masquelier, AFRL/HESR, DSN 986-7005, Comm 937-656-7005, barbara.masquelier@wpafb.af.mil)**

Service Manual Generation

Objective. Reduce the cost while increasing the quality of maintenance manuals by integrating and automating the creation of maintenance technical information contained in technical orders.

Approach. Through a dual-use, research and development effort, the Air Force is teaming with industry to develop innovative approaches to automating the manually intensive, service manual development-and-validation process. Advanced software algorithms will be developed to automatically determine disassembly sequences from computer-aided-design system models. Natural language algorithms will be developed to convert the sequential information into written instructions describing each step in the maintenance procedure. Virtual validation techniques will allow technical procedures to be rehearsed and checked for accuracy on a personal computer much earlier in the development cycle. The technical data will be generated directly from design models, ensuring concurrency with system configurations.

Expected Payoff. A more integrated process for developing technical manuals, providing higher quality information earlier in the development process. The result will be faster, cheaper, more accurate, and more complete service manuals for both Department of Defense and commercial products. A major benefit of Service Manual Generation will be increased sortie generation. Repairs will be made faster and with fewer maintenance errors due to more timely and accurate maintenance manuals. Another benefit will be a reduced overall development cycle time for manuals, leading to near elimination of the maintenance documentation lag so common in current systems. Due to the number of manual tasks being automated, the cost of developing maintenance manuals will be significantly reduced. Finally, the technology produces a robust training medium as a by-product of the new design process. **(Jeff Wampler, AFRL/HESS, DSN 785 7773, Comm 937-255-7773, jeff.wampler@wpafb.af.mil)**

Global Air Mobility Advanced Technologies

Objective. Reduce decision-cycle time and error rates of Air Mobility Command's (AMC) command and control operations through development of human computer-interface technologies: intelligent agent-supported work-centered support systems (WCSS).

Approach. Traditional human computer interfaces have a system and process-level focus and, therefore, only provide support for a relatively narrow range of situations. They are typically organized around access to system data and support for low-level work processes, not direct support for the actual decisions the user must make. This arrangement requires the user to initiate most activities (such as seeking relevant information—often from multiple sources and systems) and to manually fuse the information into a form meaningful at the job function level and relevant to the decision. In contrast, a WCSS focuses on supporting decision making through job-level analyses and designs supporting the structure of the work and wide range of anticipated and unanticipated decisions the user may be asked to make. It uses cognitive task analysis and other methods based on cognitive psychology to create designs consistent with human capabilities and limitations in the context of performing work. The WCSS provides a single interface for the entire range of decisions a user or job position may be asked to make. The interface functionality includes decision support, work organization and management, collaboration, and product support. The information is presented to the user in a *decision quality* format such that the user is freed from the preprocessing necessary to reach that state. The work-structure-based design provides an interface supportive of both anticipated and unanticipated decisions. Supporting the WCSS is another cognitive psychology-based technology; namely, intelligent software agents, a form of artificial intelligence. The software agents are embedded within the interface to act as personal assistants, proactively tracking information and alerting the user of problems, and as portals to diverse command and control (C2) systems. By integrating intelligent interface agent and WCSS technologies into a single, unified interface, dramatic decreases in decision cycle time and error rates have been demonstrated.

Expected Payoff. The Global Air Mobility Advanced Technologies (GAMAT) program will deliver three primary products: Work-Centered Support System for Global Weather Management (WCSS-GWM), Agent Management Tool (AMT), and Work-Centered Support System for Distributed Mobile Computing (WCSS-DMC). The WCSS-GWM will enable real-time identification and resolution of weather problems affecting air mobility missions while simultaneously increasing the amount of weather and mission data that can be effectively monitored and used. The AMT will provide a new capability enabling operational users (as opposed to specialized software programmers) to create and destroy software agents, as necessary, to meet unique information requirements. The WCSS-DMC will provide a distributed collaborative, decision-support capability that will enable geographically and time-distributed elements of AMC's C2 system to identify and resolve operational problems. The GAMAT technologies directly support the AMC 2000 command-and-control modernization program's integrated flight management concept of operations and will provide new operational capabilities not currently available to its users. Collectively, these technology products will improve the velocity, throughput, safety, and efficiency of the global airlift

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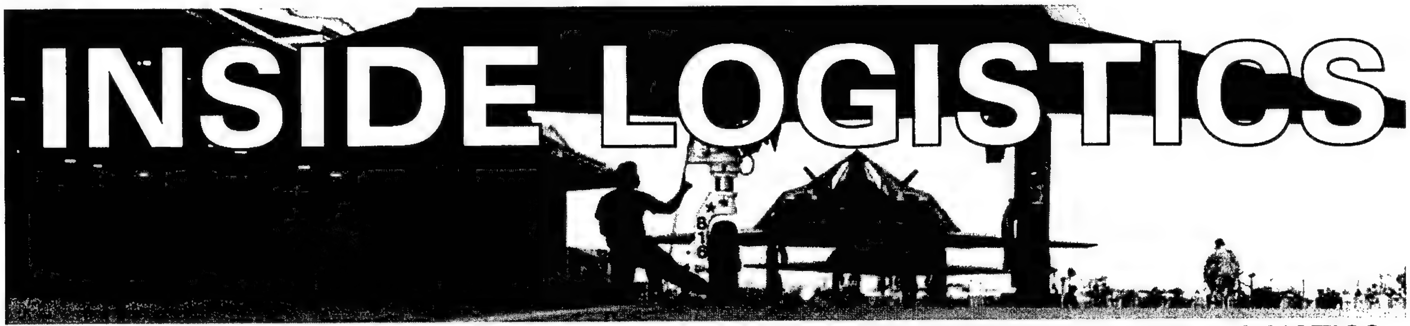

EXPLORING THE HEART OF LOGISTICS

Bladders or Bust—Is There A Better Way?

First Lieutenant Merlinda B. Vergonio, USAF

If you ask fuels people about their deployment to Prince Sultan Air Base (PSAB), the first thing to come to mind will probably be fuel bladders. The 363d Expeditionary Wing fuels flight manages more than 4.5 million gallons of jet fuel per month. On a daily basis, it issues, receives, and transports close to 200,000 gallons to support 12 different weapon systems and coalition aircraft. To supplement this demand, the 363d pioneered use of 210,000-gallon, fabric-coated tanks to store JP8 fuel. Before the these tanks were put into service at PSAB in 1998, 50,000-gallon bladders were the only size available. The larger bags increased the storage capacity and decreased the number of locations needed to place and maintain bladders. However, the bigger bags had bigger leaks.

These bigger bags with bigger leaks caused *patch masters* countless hours in repair time. After a leak was identified, all fuel had to be transferred from one bladder to another. Once the transfer was completed, the patching game began, which took several days. This process not only consumed man-hours but also caused a loss in storage capacity.

The manufacturer, Reliance Aeroproducts, was contacted concerning the quality and effectiveness of these larger bags. Reliance reengineered the bladders and delivered four to the 363d in August 2001. These new fuel tanks were adjusted to include wider seams and thicker, heavier material on the outer fabric. The fuels flight eagerly went to work to install two of the improved bladders but were disappointed when seams ripped causing more leaks as the fuel was added. The fuels flight decided to prepatch the second pair of bladders where they thought there might be weak spots, thus reducing the time spent going through the *patch mastering* process. The results were not much better. Reliance again was asked to reevaluate the fuel bags. Reliance agreed not only to ship three upgraded bladders but also to come to PSAB and review installation and filling procedures.

To enhance the field evaluation process, Reliance selectively modified the three bladders and conducted additional tests in a desert environment. It pre-installed *triple seam* patches on one of the bladders and made bigger corners on another. The third bladder was left unchanged to serve as a control. These changes were made at the factory to determine what could be done to reduce repetitive maintenance and repairs in the field.

After arriving at PSAB in October 2001, the contractors assisted flight personnel in installing the three new bags. All

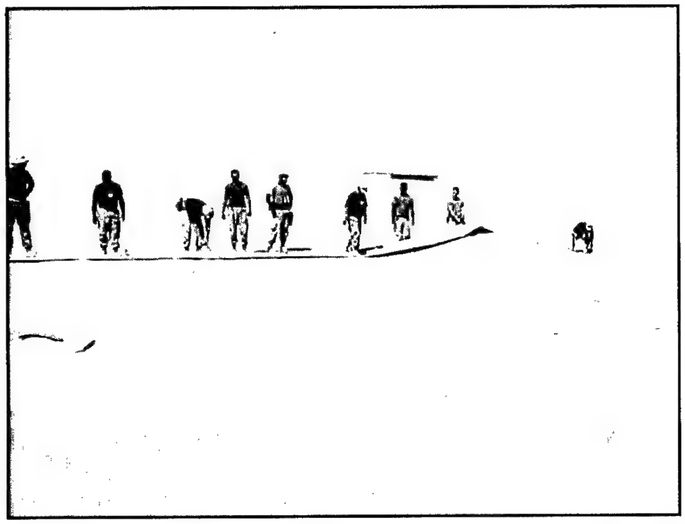

Figure 1. Overlooking 210K Bladder After Installation

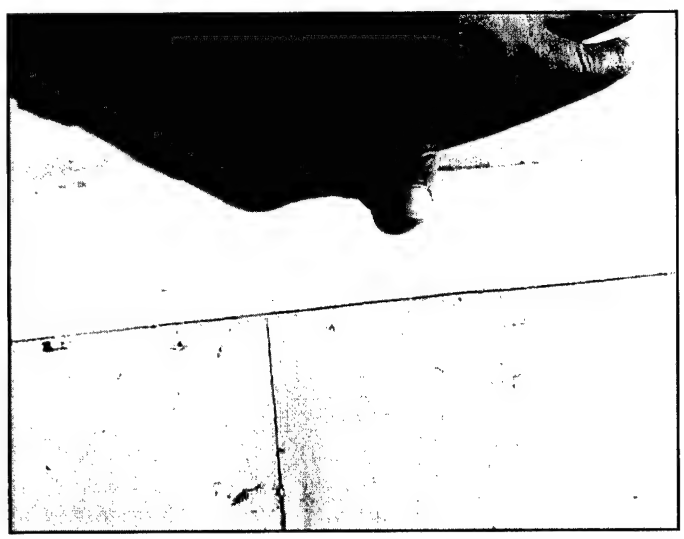

Figure 2. A Leak at the Triple Seam

bladders were inspected and minor preventive maintenance completed before adding fuel. The bag, modified with larger corners—bag MB4-01—still developed a minor seep. The seep was fixed with a clamp and an application of a liquefied rubber sealant called back brush. Bag MB4-08—customized with pre-installed *triple seam* patches—leaked after filling the bag with just 50,000 gallons of JP8 fuel.

Reliance representatives observed POL personnel's bladder-patching routine and offered their own mending techniques. Both teams were able to exchange valuable tips on site. Reliance took away ideas for improving its product; for example, it plans to send installation kits with new bladders. The kits will consist of new screws, seals, and grease to ensure proper fastening of the door fittings on the bladders. While installation kits are not part of the contract, Reliance must guarantee no seepage in these areas. Another suggested amendment includes pre-installation of patches at all *triple seams* to reinforce the joints and prevent possible seepage. Also, Reliance will make bigger corners similar to one of the test tanks installed during the visit. So far, the larger corners have proven to be more stable and are working well.

After watching the field installation process and talking with flight technicians, Reliance identified changes to reduce stress on the 210,000 bladders. It plans to move the fittings required for the bags so they all line up on one panel. Currently, the fittings are located according to the specifications outlined in MIL-T-53066B, which illustrates them staggered on different panels.

Furthermore, Reliance will change the way bladders are rolled during packing for future deliveries. According to the mil-spec, the bladders must be rolled at each end and meet in the middle.

Figure 3. Installing Fittings on Bladder

Figure 4. Burrito-Style Roll

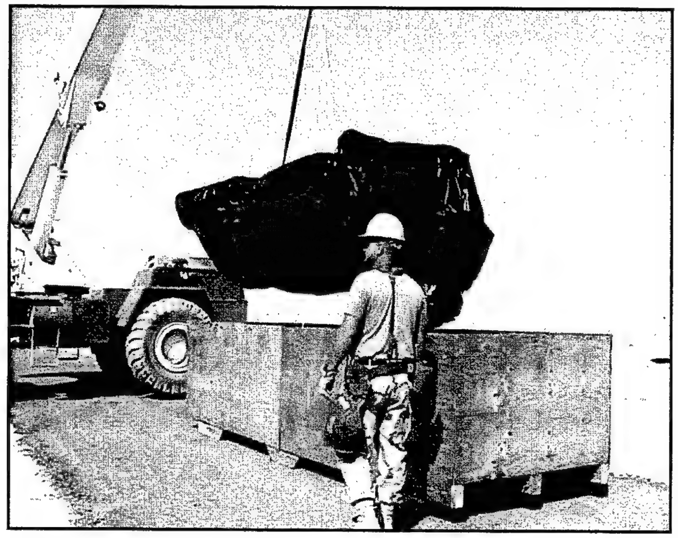

Figure 5. Bladder Getting a Lift

The bags will now be rolled from one end to the other, similar to a burrito, which will allow the bag to be unrolled more easily from one end of the berm. This will reduce dragging or constant repositioning of the bag. Currently, to achieve proper positioning, the bag has to be placed exactly in the middle of the berm, which is difficult with limited equipment.

Finally, Reliance will improve the 2-3-inch sling straps used to lift the bag out of its crate. In the future, Reliance will use a full-body sling to eliminate the stress and ensure even distribution of weight.

Another initiative resulting from the visit is the need to continue looking for better patching products. It will provide the fuels flight with PRC, better known as aircraft fuel cell adhesive, to use in repairing seeps. POL personnel will provide feedback to Reliance on the reliability of the product. Additionally, they will also conduct experiments with the use of a Kevlar ingredient on the inner tank to observe its effect on the seams. This test will take time and be accomplished at the manufacturer using a smaller tank. Testing is expected to take 6 months. If the Kevlar product is a success, then Reliance will attempt to transform it into a spray that can be used easily in the field.

In support of Operation Southern Watch, the 363d will continue to supply storage for jet and ground fuel using 210,000-gallon bladders. Because it is the first user of the 210,000-gallon tank in this desert environment, if not worldwide, it must continue to test and scrutinize its quality and performance. And it must rely on Reliance Aeroproducts since it is the only known company manufacturing a bladder this size.

Reliance and PSAB's expeditionary fuels flight are working together to find better ways to manufacture a desert-quality fuel bladder. Fuels management will forward any findings and recommendations to the Air Combat Command and Army Tactical Command, the main procurer of fuel bladders.

Lieutenant Vergonio is the Fuels Management Flight Commander, 62d Supply Squadron, McChord AFB, Washington. At the time of the writing of this article, she was deployed to the 363d Expeditionary Supply Squadron, Prince Sultan Air Base, Saudi Arabia.

(Pitfalls of the A-76 Process continued from page 1)

these factors, and by interviewing those performing the process, it is possible to identify gaps in training and experience. Experts on the process can also identify disconnects between theory and implementation. Contractors and MEOs can determine if the expected results are achieved.

Expected Gains

The first step in understanding the outsourcing process is knowing what the overarching gains are supposed to be and what causes these gains. The next step is to determine what the specific gains are supposed to be for the Air Force and if the gains are encouraged in the environment in which the process works. The third step is to examine how the process is implemented, making sure there is no disconnect between theory and application.

While the overarching, outsourcing goals are different for each group, they can be determined from past examples. These examples reveal two benefits outsourcing produces simultaneously. The first is cost reduction. The second is the income to the government from corporate taxes (vice a drain on government funds). Margaret Thatcher proved this in 1979 when she began privatizing various functions of her government, with great success.

In Britain, a number of nationalized industries were requiring \$600 per taxpayer annually in subsidies to avoid bankruptcy.[2] Their drain on the nation was immense. After the industries were privatized, they were paying \$200 dollars per taxpayer into the national treasury annually. Privatizing these functions resulted in a annual net gain of \$800 per taxpayer. Drawing upon this example, it could be suggested that Congress hopes to attain two things by encouraging outsourcing of selected military functions. The first would be a reduction in the cost of these services. The second would be the generation of income from taxes that would exceed the amount spent to purchase the functions.

However, simply turning a function over to the private sector does not make it a success. There must be something working in the private sector that does not exist in the public sector. In 1972, the World Bank studied the effects of privatization in four nations: Britain, Chile, Malaysia, and Mexico. It found the driving factor behind the success of privatization was the new-found ability to "hire and fire employees and to craft compensation packages that reflected the true value of individual productive output."[3] This fact is critical to the success of any outsourced or privatized function; the new firm must be able to hire, fire, and compensate according to prevailing market levels .

The government trades wages against job security. While the government often does not pay the prevailing market wage for many of its jobs, it does offer job security that is unmatched in the private sector. As a result, the government may not attract the most qualified personnel or hire them quickly. The converse is true in the private sector.

Now that the driving force behind all outsourcing has been determined, the question is, will it be allowed to work in the existing system? Two contractors from Tyndall AFB, Florida, and Wright-Patterson AFB, Ohio, were interviewed about the hiring and firing process. They noted positions within their organizations were assigned a wage-grade cap, which the government would pay. While they were free to give higher wages or hire more people, the extra cost would come out of their profits.[4] As a result, the contractors were not inclined to hire more people or pay more than the government would reimburse. When asked about the firing process, both contractors noted two serious impediments to firing: government regulations and the immense power of the unions. As a result, the contractors were unable to hire quickly or fire their employees.

The heads of two MEOs from Edwards AFB, California, and Wright-Patterson AFB were also interviewed about the hiring and firing process. While the MEOs were smaller than the organizations they replaced, they were locked into pay grades and regulations as the previous units had been. As a result, they could not quickly hire or fire employees for the same reason noted previously. However, the MEOs had an additional problem in hiring employees—morale, which tends to be extremely low in MEOs.[5] Morale was so low workers had been known to turn down promotions that placed them in an MEO.[6]

As these four organizations revealed, no matter who wins the contract, the new provider does not seem to be able to acquire or terminate employees quickly. The MEO operates under the same restrictions as other government agencies, so its ability to quickly hire and fire is no better than any other government organization. The contractor is more capable of hiring and firing but faces restrictions from government funding and regulations, as well as union restrictions.

Air Force Goals

The next step in finding how well the outsourcing process works is to establish specific Air Force goals and determine if the environment is conducive to them. The dominant argument for outsourcing is that it produces savings. Former Air Force Chief of Staff General Ronald R. Fogleman and Former Secretary of the Air Force Sheila Widnall both stated to the Air Force News that the primary reason for outsourcing was to produce savings in both money and manpower.[7] The new organizations are supposed to be more efficient, which means fewer people and a cost savings. Consequently, outsourcing is useful only to the extent it produces savings.

The current budget system is essentially a trickle-down and trickle-up system. Each military need falls under a specific category such as construction, research and development, or operations and maintenance. Congress designates a certain amount of money for each category. Money for each category is dispensed at the top of the military chain of command and distributed down to the lower levels. At the end of the year, money not used in each category is sent up to the next higher level for expenditure. Whatever money is not used by the entire chain of command for that category is returned to Congress in the form of savings. Congress then reduces the next year's budget by the amount saved in that category. This creates a disincentive to reveal savings within the Department of Defense (DoD), creating a *use it or lose it* mentality. As a result, DoD—and every level within it—has a strong incentive to hide savings. As long as this is the case, the military will not realize a great deal of savings.

Theory Versus Application

The final step in examining the A-76 process is to evaluate how the process is conducted to see if theory and application mirror each other. One of the leading experts on the A-76 process is Lieutenant Colonel William Stockman, a professor at the Air Force Institute of Technology. He notes one of the problems with the process is the teams formed to develop the PWS and the MEO rarely have the background needed to perform the task. Most of the people are drawn from within the base or even the organization under review. These personnel are rarely task evaluation experts or cost analysts. While most of them have jobs related to the functions under evaluation, they may not be qualified to evaluate the individual tasks necessary for inclusion in the PWS or the cost of such services. In addition, this is probably the first time anyone on the team has ever performed this kind of work. Because of the background and inexperience of the group, they will need to be trained on how to perform the evaluation. However, the developers of the PWS at Edwards AFB and Wright-Patterson AFB both commented that training was hardly sufficient.[8] Both said the training was roughly 1 week in duration, covered mostly after-action administrative actions, and simply did not prepare the group for the task at hand. Colonel Stockman stated such experiences were common throughout the Air Force.[9] Teams are not prepared by the Air Force for the tasks assigned, so the Air Force has no realistic knowledge of the cost or work being evaluated.

The problems with the process do not end here. There is no set way to develop a PWS. The two developers interviewed built their PWS by estimating the importance of each task and interviewing the workers. Both of them noted a huge problem with this process—the personnel interviewed engaged in *work hiding* and *work exaggeration*.[10] Work hiding is leaving work critical to the mission unstated, which results in its not being included in the PWS. Work exaggeration is exaggerating unimportant work to the point it is deemed critical and included in the PWS. Because teams are inexperienced, they cannot readily identify when work hiding or work exaggeration occurs.[11] When either occurs, errors, which the Air Force is unaware of, are created in PWSs and will need to be corrected in the future. However, it is a completely different story for the contractor.

Contractors bring personnel with the accounting, analytical, and task evaluation backgrounds necessary for the jobs on which they are bidding. In addition, they often have the advantage of having performed similar work for other bases or related businesses. While the area of the country may be different and the missions slightly different, the tasks are probably extremely similar from one base to another or to a related private sector company. Because contractors have this experience and have performed the work, they are in a better position to know the true cost of performing to the PWS and how soon it will need to be rewritten.[12] With their background and experience, contractors can identify holes in the PWS and have a better understanding of its true cost.

When the GAO was asked to verify the savings of outsourcing in the DoD over the last 5 years, it was unable to do so. The primary reason was that PWSs had changed so many times from the contract's initial award it was impossible to determine the true extent of the savings.[13] A related GAO report showed saving estimates were often based on authorized manning levels, rather than assigned manning levels.[14] This observation was confirmed by MEO team leader Charlene Gipson when she stated, "Our organization was cut about 68 percent in authorized manning slots; however, only 40 percent of the cuts were of authorizations assigned to perform tasks that were outsourced." While savings are occurring, their true extent cannot be determined and are probably much less than estimated.

When the conclusions of each part of the process are reviewed, a very broken process begins to emerge. While outsourcing can work, it does so only because the private sector is capable of quickly hiring and firing people. Within the existing process, however, this ability is negated by the government regulations imposed upon the MEOs and contractors and is further hindered by concessions made to the unions. The driving factor behind the success of outsourcing has been effectively removed from the current process because wage rates in the new organization do not reflect prevailing labor market rates and it cannot quickly eliminate those employees who do not perform to job standards.

To further compound the problem, the main reason for outsourcing is to produce savings within DoD, savings that will ultimately be returned to Congress. However, the process is embedded in a system that actively discourages savings. The military budget system encourages the hiding of savings, so the majority of savings from outsourcing or any other program will be hidden. Congress is essentially punishing the military for the very behavior it wants.

Even if the other two problems were corrected, a third problem remains. Because of the lack of skill and experience of teams preparing PWSs, the Air Force does not know where work hiding and work exaggerations have occurred and, consequently, cannot build accurate cost estimates. The Air Force does not have a true understanding of the cost or the work, so any saving estimates are inaccurate.

Conclusion

These three conclusions ultimately lead to one overriding conclusion. Outsourcing is good only so far as it provides the same level of service as the previous provider at a lower cost to the Air Force. However, the process has been disconnected from the driving forces behind its success, and the Air Force does not know what the organic level of service truly is or was. As a result, the process is broken and will not produce the desired effects as it is currently being implemented.

There is hope of producing the desired results, however. Three major changes can be implemented that will produce stronger gains and make it easier to meet the desired goals. The first change would be to alter the military budget system to encourage revealing savings. One way to do this is to allow the military more freedom in spending money and allow transfer of savings from one year to the next. This will allow dollars saved in support functions to be spent on purchasing equipment or on research and development. In addition, the rollover of savings will let commanders prepare for high-expense years with savings gained from low-expense years.

Another change that can be implemented is cutting both MEOs and contractors loose from governmental regulations that slow down the hiring and firing process. Paying higher wages will attract those who are most qualified. While these employees

may cost more than lower paid employees, they will probably be more efficient, so the net gains will be higher. In addition, the ability to fire employees who do not measure up to standards will free up resources for employees who do meet standards and increase the morale of the remaining workers, who will see hard work rewarded and poor work eliminated.

Colonel Stockman recommends having core teams of PWS and MEO developers. These teams will have members with the proper background, and the teams will have the time for the proper training and gain experience as each A-76 is performed. The teams, developed and deployed in much the same way as Inspector General compliance teams, will be able to identify hiding and work exaggeration and develop better cost estimates for functions under evaluation. There is one drawback to this plan: over time, team members will begin to lose currency in their career functions. However, by staggering rotation of team members and having a tour length of only a few years, this disconnect can be reduced.[15] These teams will produce greater efficiency in the outsourcing process, which will ultimately produce greater savings.

Outsourcing is a tool, and like any other tool, it must be used correctly and in the proper environment if the desired goals are to be achieved. The military and Congress are currently using outsourcing in the wrong environment and are implementing it incorrectly for producing the desired gains. But the system can be fixed. While outsourcing may prove itself in the future, as it currently stands, the process cannot and does not work as advertised.

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(Determining AGE Levels Continued from Page 23)

Implications

SGNSC is currently being fielded. Unit reliability is uncertain, but historical AGE data and modular aircraft support system research yielded reasonable bounds for MTBF data. This study failed to judge MTBF as a prime driver for SGNSC BOI.

Utilization and wait time were inversely related. High utilization should not become a factor for SGNSC BOI as it comes with a high a cost to the maintainer.

The BOI driver seemed to be the unit surge mission. While still yielding excess peacetime capacity, the resulting inventory levels were a fairly nice reduction in planned inventory levels (28 percent in this case).

Recommendations

AGE utilization was very low, and demands for AGE resources overstated. The current overabundance of AGE on the flight line is unaffordable in today's Air Force. The methodology yielded a useful, objective basis in determining AGE levels for new and existing programs and should be used in conjunction with current methods for more insight into AGE inventory levels.

The model promotes a reduction of AGE to at least an inventory of 12 plus 1 for transient aircraft. MTBF effects are minimal, and it is postulated that a spare for the transient support is unnecessary, provided transient support may borrow an SGNSC from the home-station AGE shop. This would mean an inventory of 13 SGNSC vice the current 18 programmed for Travis by AMC. The current contract for SGNSC, at $20M for 570 carts, is about $35K per cart. A reduction of five SGNSC would mean a reduction of about $175K in acquisition costs. If the model could be extended, the possibility of a 28-percent reduction in SGNSC acquisition costs would amount to about $5.6M over the life of the contract. These reductions in AGE levels Air Force-wide would also have the benefit of cost avoidance in operations and maintenance costs.

While the results are positive, this study only attempted to estimate actual requirements. The results did not incorporate war reserve materiel, deployment, or other potential demands or outside limiting factors, only demands anticipated at Travis AFB. It must be remembered these were estimates only and should be taken into consideration with other factors and experience before applying any results to the field. However, the results gave a reasonable estimation of the potential cost savings in reduced procurement costs.

One of the issues in optimizing a certain part (SGNSC) of an interrelated system is the effect on other parts of the system or the flight line. Reducing SGNSC may increase utilization, but AGE drivers may still be insufficient. Waiving reliability requirements may not have a serious effect on wait time, but AGE shop manpower may need to be increased. This study only examined the effects of reducing AGE levels to meet expected mission requirements. When a resource pool is reduced, other issues may arise.

Summary

An important issue discovered in the analysis of AGE-inventory sizing was the wait time for AGE. A queuing simulation was ideally suited to the fluid environment of the flight line, and WUCs were the most accurate indicator available to derive AGE consumption. Adjusting AGE inventory to minimize wait time or keep it down to an acceptable level was the prime measure of AGE mission effectiveness.

This study is not a mathematical formula to quantify the number of SGNSC carts needed on the flight line. The research was a more objectively oriented approach to identify those aspects of actual AGE needs on flight-line operations that have the greatest impact and the relative consequences of adjusting AGE inventory levels.

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(Defense Working Capital Fund continued from page 32)

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(Current Research continued from page 35)

system by enabling more accurate and timely decision making through 24/7 global monitoring; automatic problem detection and anticipation; and distributed, collaborative problem resolution. **(Sam Kuper, AFRL/HESS, DSN 785-9684, Comm 937-255-9684, sam.kuper@wpafb.af.mil)**

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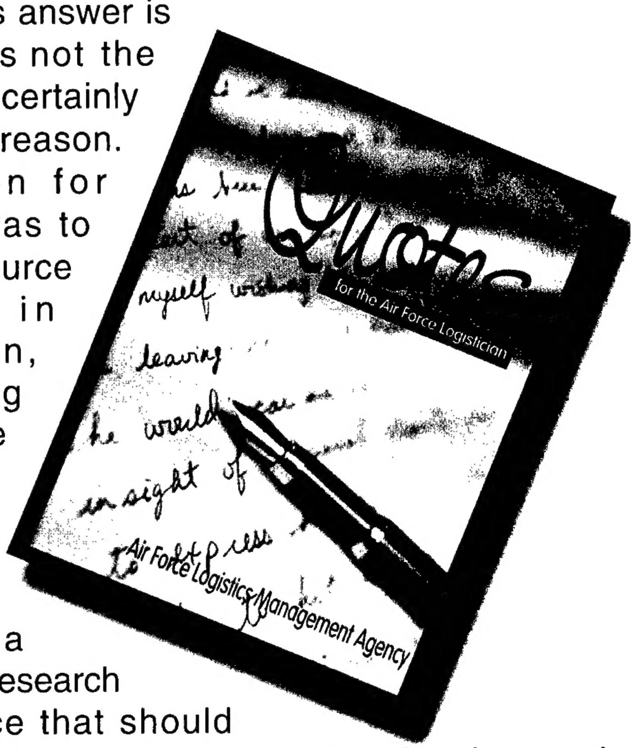

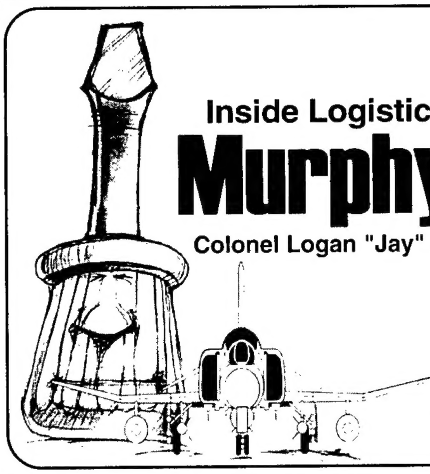

Inside Logistics

Murphy's Law

Colonel Logan "Jay" Bennett, USAF, Retired

The single most important thing controllable at wing level that will advance the sortie-production goal is to follow the weekly flying schedule.

The Editorial Advisory Board selected "Murphy's Law"—written by Colonel Logan "Jay" Bennett, USAF, Retired—as the most significant article to appear in the *Air Force Journal of Logistics*, Vol XXV, No 3.

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